

P R O J E C T M A N U A L

SALT LAKE CITY INTL AIRPORT GATEWAY BRIDGE FIRE DOOR REPLACEMENT TBC-2-003, PBE-2-001, & PBW-2-001

CONSTRUCTION DOCUMENTS BID SET

DIVISION 1, 2, 5, 6, 7, 8, 9, 21, 26, 28


MHTN PROJECT NO. 2025536
15 OCTOBER 2025



vision made **real**

000107 - SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

 10/15/25 ARCHITECT	N/A LANDSCAPE ARCHITECT	N/A CIVIL ENGINEER
N/A STRUCTURAL ENGINEER	N/A ELECTRICAL ENGINEER	N/A MECHANICAL ENGINEER
N/A FIRE PROTECTION ENGINEER	N/A GEOTECHNICAL ENGINEER	

All professional seals (stamps) to be signed and dated; Architect Licensing Act Rules R156-3a, Utah Administrative Code, paragraph 601 and Professional Engineers Licensing Act Rules R156-22, Utah Administrative Code, paragraph 601.

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SECTION 011000 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished/Owner-installed (OFOI) products.
4. Contractor's use of site and premises.
5. Work restrictions.
6. Specification and Drawing conventions.
7. Miscellaneous provisions.

- B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 DEFINITIONS

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

1.4 PROJECT INFORMATION

- A. Project Identification: SLCIA Terminal Building

1. Project Location: 3920 West Terminal Drive, SLC, 84122

- B. Owner: Salt Lake City Department of Airports

1. Owner's Representative: Erik Groethe

- C. Architect: MHTN Architects, 280 South 400 West Suite 250, Salt Lake City, UT 84101.

1. Architect's Representative: James Knight

- D. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

- 1. Use web-based software including the following applications:
 - a. Bluebeam, Revu.

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

- A. The Owner will furnish and install products indicated.
- B. Owner-Furnished/Owner-Installed (OFOI) Products:

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits on Use of Site: Confine construction operations to tenant improvement activities and other work identified in the Drawings.
 - 2. Driveways, Walkways and Entrances: Keep driveways parking garage, 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 for 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.
- B. Parking: Available parking per Owner
- 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.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to hours indicated by Owner
- C. Smoking and Controlled Substance Restrictions: Use of tobacco products (unless otherwise indicated by CMGC), alcoholic beverages, and other controlled substances on Project site is not permitted.

- D. Employee Identification: If required by Owner, require personnel to use identification tags at all times.
- E. Employee Screening: Comply with Owner requirements for drug and background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 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 scheduled on Drawings and published as part of the U.S. National CAD Standard.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions" or similar type form.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 7 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used).

END OF SECTION 012500

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Web-based Project management software package.
 - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Construction Manager/General Contractor seeking information required by or clarifications of the Contract Documents.

1.4 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, telephone number, and email address 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.

- B. Key Personnel Names: Within 10 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

1.5 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 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. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
- b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
- c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- f. Indicate required installation sequences.
- g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate sub framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab 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. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:

- a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
 2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
 3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
 4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
 5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
 6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
 7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.
- D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format:
 - a. Same digital data software program, version, and operating system as original Drawings.
 2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
 3. BIM File Incorporation: Construction Manager will incorporate Subcontractor's coordination drawing files into BIM established for Project.
 - a. Construction Manager will perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 - b. Subcontractors listed below shall provide coordination drawings in the form of a Revit 2020 model, developed to LOD Level 350, for incorporation into the Construction Manager's model.
 - 1) Electrical.
 - 2) Mechanical.
 - 3) Plumbing.
 - 4) Fire Protection.

5) Other's as requested by the Construction Manager.

4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in Revit 2020.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner 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. Owner name.
 3. Owner's Project number.
 4. Name of Architect and Construction Manager.
 5. Architect's Project number.
 6. Date.
 7. Name of Subcontractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.
 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 14. Contractor's signature.
 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect.
 1. Attachments shall be electronic files in PDF format.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow five days for Architect's response for

each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. 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 by Architect 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 Section 012600 "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 5 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. Use software log that is part of web-based Project management software. Software log with not less than the following:

1. Project name.
2. Name and address of Subcontractor.
3. Name and address of Architect and Construction Manager.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Revit 2020.

4. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 - a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement included in this Project Manual.
- B. Web-Based Project Management Software Package: Use Construction Manager's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
 1. Web-based Project management software includes, at a minimum, the following features:
 - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Track status of each Project communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creating and distributing meeting minutes.
 - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility, including smartphones and tablets.
 2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare 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.
 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 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 a minimum of seven days prior to meeting.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, 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. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises and existing building.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.
 - aa. Security.
 - bb. 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 when required by other Sections and when required for 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 requirements.
 - 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. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 45 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. 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 meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Procedures for completing and archiving web-based Project software site data files.

- d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Coordination of separate contracts.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. 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.
 - 3. 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) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of Proposal Requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.

- 19) Documentation of information for payment requests.
4. 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.
- F. Coordination Meetings: Construction Manager will conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Status of RFIs.
 - 15) Proposal Requests.
 - 16) Change Orders.
 - 17) Pending changes.
 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Preliminary Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Daily construction reports.
 - 4. Field condition reports.
 - 5. Special reports.
- B. Related Sections include the following:
 - 1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
 - 2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
 - 3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
 - 4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.
 - 5. Division 1 Section "Closeout Procedures" for submitting Project Record Documents at Project closeout.

1.3 SUBMITTALS

- A. Preliminary Construction Schedule: Submit two printed copies; one a single sheet of reproducible media, and one a print.
- B. Contractor's Construction Schedule: At monthly 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.
- C. As the Work progresses, indicate Final Completion percentage for each activity
- D. Daily Construction Reports: Submit one copy at weekly intervals.

- E. Field Condition Reports: Submit one copy at time of discovery of differing conditions.
- F. Special Reports: Submit one copy at time of unusual event.

1.4 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination. "Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Discuss constraints, including phasing, storage areas.
 - 2. Review time required for review of submittals and resubmittals.
 - 3. Review requirements for tests and inspections by independent testing and inspecting agencies, If required
 - 4. Review time required for completion and startup procedures.
 - 5. Review and finalize list of construction activities to be included in schedule.
 - 6. Review submittal requirements and procedures.
 - 7. Review procedures for updating schedule.

1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work including delivery of equipment from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for commencement of the Work or the Notice to Proceed to date of Substantial Completion.
- C. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 - 1. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 30 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

2. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 3. Startup and Testing Time: Include days for startup and testing as required by the Electrical Consultant.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- D. 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 or separate areas of the work,
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Uninterruptible services.
 - c. Use of premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
 3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards, if any.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.
 - e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Startup and placement into final use and operation.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, Percentage completion milestones and Final Completion.
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

2.2 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, if any.
 2. List of separate contractors at Project site where applicable
 3. Approximate count of personnel at Project site.
 4. High and low temperatures and general weather conditions.
 5. Accidents.

6. Meetings and significant decisions.
7. Unusual events (refer to special reports).
8. Stoppages, delays, shortages, and losses.
9. Emergency procedures.
10. Orders and requests of authorities having jurisdiction.
11. Change Orders received and implemented.
12. Construction Change Directives received.
13. Services connected and disconnected.
14. Equipment or system tests and startups.
15. Partial Completions.
16. Substantial Completions.

- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare 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.

2.3 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: Submit initial copy with Request for proposal. At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one day 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 Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, sub-contractors, testing and inspecting agencies, if applicable 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 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
 - 5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

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

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list 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 additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.
 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.

16. Signature of transmitter.

- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
- 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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves 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.
 - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. 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 action stamp.
- E. 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.
- F. 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 action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. 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 unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. 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 that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. 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. BIM Incorporation: Develop and incorporate Shop Drawing files into BIM established for Project.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
 - 1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 - 3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 - 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 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 will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

- 2) 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.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. 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.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. 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.
 3. 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.
 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 2. 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.
 3. 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.

4. 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.
5. 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.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 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 insufficient 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 file and two 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.
- C. BIM Incorporation: Incorporate delegated-design drawing and data files into BIM established for Project.
 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as original Drawings.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include 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.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 1. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
 - a. Actions taken by indication on Project management software website have the following meanings:
 - 1) Final Unrestricted Release: Where the submittal is marked "No Exception Taken," the Work covered by the submittal may proceed, provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - 2) Final-but-Restricted Release: Where the submittal is marked "Make Corrections Noted," the Work covered by the submittal may proceed, provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
 - 3) Resubmit: Where the submittal is marked "Exception Taken - Resubmit" do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to Architect's notations and corrections.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 – QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REQUIREMENTS INCLUDED

- A. General Quality Control
- B. Workmanship
- C. Manufacturer's Instructions
- D. Manufacturer's Certificates
- E. Manufacturer's Field Services
- F. Testing Laboratory Services

1.3 RELATED REQUIREMENTS

- A. General Conditions: Inspection and testing required by governing authorities.
- B. Division One Section for Submittals: Shop Drawings, Product Data, Manufacturer's Instructions.

1.4 QUALITY CONTROL - GENERAL

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.5 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.6 MANUFACTURERS' INSTRUCTIONS

- A. Comply with instructions in full detail, including each step, in sequence. Should instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

1.7 MANUFACTURERS' CERTIFICATES

- A. When required by individual Specifications Section, submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

1.8 MANUFACTURERS' FIELD SERVICES

- A. When specified in respective Specification Sections, require supplier to provide qualified personnel to observe field conditions, quality of workmanship, as applicable, and to make appropriate recommendations.
- B. Representative shall submit written report to Engineer listing observations and recommendations.

1.9 TESTING LABORATORY SERVICES

- A. Owner will employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual Specification Sections.
- B. Services will be performed in accordance with requirements of local jurisdiction having authority and with specified standards.
- C. Reports will be submitted to Owner in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with Contract Documents.
- D. Contractor shall cooperate with Testing Laboratory personnel; furnish tools, samples of materials, mix design, equipment, storage and assistance as requested.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 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.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.
- D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.
- J. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such

as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

- K. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 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 the date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 - 1. 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 the requirements. Refer uncertainties to Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on Project must 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 the publication source and make them available on request.
- E. Abbreviations and Names: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This 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 Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 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: Where a specific manufacturer's product is named and accompanied by the words "basis of design", "Design Standard" or similar, 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 other named manufacturers submitted as an equal product.
- C. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- D. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 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. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 2. 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 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 Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 3. Initial Submittal: Within 5 days after date of commencement of the Work, submit 8 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 4. Completed List: Within 7 days after date of commencement of the Work, submit 8 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 5. Architect's Action: Architect will respond in writing to Contractor within 7 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
 6. Substitution Requests: Will not be considered due to the limited construction time frame of this Project.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 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.
 - 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 ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 - 5. Store products to allow for inspection and measurement of quantity or counting of units.
 - 6. Store materials in a manner that will not endanger Project structure.
 - 7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 9. Protect stored products from damage.
- B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment. Coordinate location with Owner.

1.7 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.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, 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. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures: Procedures for product selection include the following:
1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named or an approved equal,
 2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements or an approved equal.
 3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirement or equal. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements, or equal.. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another equal product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
 6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements as an equal. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
 7. Basis-of-Design Product: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Products" or "Design Standards" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with

- provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
 9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes 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.
 - 9. Correction of the Work.
- B. Related Sections:
 - 1. Division 01 Section "Submittal Procedures" for submitting surveys.
 - 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 "Through Penetration Firestop Systems" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.

1.5 QUALITY ASSURANCE

- A. 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 the 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. Conveying systems.
 - i. Electrical wiring systems.
 - j. 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. Equipment supports.
 - c. Piping, ductwork, vessels, and equipment.
 - d. 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.

- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. 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. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. 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.

- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. 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 the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 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 promptly.
- B. General: Engage a professional engineer 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 dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 6. 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

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. 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.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- 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.
- D. Final Property Survey: Engage a professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 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.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- 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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. 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.
- G. 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.
- H. 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.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 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. Temporary Support: Provide temporary support of work to be cut.
- C. 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.
- D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."
- E. Existing Mechanical/Electrical Systems: Where existing systems are required to be removed, relocated, or abandoned, bypass such systems before cutting to minimize interruption to occupied areas.
- F. 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: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. 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.
 5. Proceed with patching after construction operations requiring cutting are complete.
- G. 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.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
3. Where elements that are removed extend one finished area into another, patch and repair surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place materials and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent surfaces.

3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 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.
 - a. Utilize containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
 - 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. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management"
 - 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.
- 3.9 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."

3.10 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.

3.11 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous demolition and construction waste.

1.3 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. 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.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.
- B. Processing Facility Records: Indicate receipt and acceptance of waste by processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices for products that may be recycled, if any.
- C. Landfill Disposal Records: Indicate receipt and acceptance of waste by landfills licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan.
 - 2. Review procedures for periodic waste collection and transportation to disposal facilities.
 - 3. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements of this Section. Plan shall consist of waste identification and analysis. 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 construction waste generated by the Work

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 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.
 - 1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management: If recycling is to be utilized for corrugated packaging or other salvable waste Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
- C. 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 or recycled.

3.2 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. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes 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.
- B. Related Sections:
 - 1. Division 01 Section "Execution" for progress cleaning of Project site.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Divisions 05 through 28 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.

9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
12. Complete final cleaning requirements, including touchup painting.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. 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.

1.4 FINAL COMPLETION

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. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect 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.

1.5 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 other form or digital service, as agreed to by Owner, Architect and Contractor, or as required by Owner.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format (verify with Architect):
 - a. PDF electronic file.

1.6 WARRANTIES

- A. Submittal Time: 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.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. 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. 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 table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 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 meet Green Seal 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

3.1 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 portion of Project:
 - a. Clean Project site in areas disturbed by construction activities of rubbish, waste material, litter, and other foreign substances.
 - b. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - c. Clean exposed interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition.
 - d. Remove debris and surface dust from limited access spaces, plenums, shafts and similar spaces.
 - e. Sweep concrete floors broom clean in unoccupied spaces.
 - f. Clean transparent materials, including glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscurating materials. Replace chipped or broken glass and other damaged transparent materials. Polish glass, taking care not to scratch surfaces.
 - g. Remove labels that are not permanent.
 - h. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
 - i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint droppings, and other foreign substances.
 - j. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - l. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - m. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.
 - n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

- o. Leave Project clean and ready for occupancy.
 - C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Sections:
 - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Divisions 05 through 28 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format (verify with Architect):
 - 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.
2. TWO paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Agent will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Agent will return copy with comments.
 1. Correct or modify each manual to comply with Architect's and Commissioning Agent's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Agent's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Agent.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.
- F. Manuals, Paper Copy: Submit not more than 2 copies of manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-

- reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
- b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Sections:
 - 1. Division 01 Section "Execution" for final property survey.
 - 2. Division 01 Section "Closeout Procedures" for general closeout procedures.
 - 3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Divisions 05 through 28 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

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

- C. Record Product Data: Submit one paper copy or annotated PDF electronic files and directories (verify with Architect) of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy or annotated PDF electronic files and directories (verify with Architect) of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated in Project record documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
 - 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. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. Refer to Division 01 Section "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. 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.
 - e. Name of Contractor.

2.2 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. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file or paper copy. Verify with Architect.

2.3 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 annotated PDF electronic file or paper copy. Verify with Architect.
 - 1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

2.4 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 PDF electronic file or paper copy. Verify with Architect.
 - 1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes 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 DVDs.
- B. Related Sections:
 - 1. Divisions 05 through 28 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 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 utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator, instructors and videographer.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training DVDs: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:

- a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, three-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use.

1.5 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. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. 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 including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. 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

2.1 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.
 - 1. Fire protection systems
 - 2. Elevators
 - 3. Electrical service and distribution and controls including transformers and switchboards, panelboards, and motor controls.
 - 4. Lighting equipment and controls.
 - 5. Communications systems including surveillance. Clocks, programming voice and data.
- 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

3.1 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 "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 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. 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 the General Contractor with at least 14 days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING DVDs.

- 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 digital recordings with menu navigation in format acceptable to Architect.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

END OF SECTION 017900

PROJECT SPECIFICATION

SECTION 05 50 10

METAL FABRICATIONS

SALT LAKE CITY INTERNATIONAL AIRPORT

4	08.24.18	Bulletin 24
3	12.15.16	Bulletin 06
2	06.10.16	Bulletin 03
1	12.18.15	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 05 50 10 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Steel framing and supports for ceiling-hung toilet compartments.
2. Steel framing and supports for overhead doors and grilles.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Miscellaneous steel supporting the following items:
 - a. Curtainwall and metal panel systems
 - b. RIDS/ADGU/Camera mounts through the façade
 - c. SS protection base plate in public areas
7. Elevator machine beams and hoist beams.
8. Mesh used in elevator shafts and between equipment.
9. Steel shapes for supporting elevator door sills.
10. Shelf angles.
11. Metal ladders and ladder safety cages
12. Safety tie-off system at roof.
13. Metal ladders installed as part of roof hatches.
14. Gratings used at elevator sumps
15. Miscellaneous steel trim including steel angle corner guards steel edgings and loading-dock edge angles.
16. Metal bollards.
17. Loose bearing and leveling plates for applications where they are not specified in other Sections.
18. Steel corner guards

- B. Products furnished, but not installed, under this Section:

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 Sections:

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 "Metal Stairs."
4. Division 05 Section "Pipe and Tube Railings."

1.3 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.

1.4 SUBMITTALS

- A. Product Data: For the following:
 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 2. Paint products.
 3. Grout.
- B. Shop Drawings: Submit shop drawings detailing fabrication and installation of each metal fabrication indicated; submit coordinated shop drawings with related trades.
 1. Include dimensioned plans, elevations, sections, and large scale details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts required in other sections.
- C. Performance Based Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer licensed in the state of Utah and responsible for their preparation.
- D. Qualification Data: For qualified professional engineer.
- E. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- F. Welding certificates. Submit welder certificates signed by the Trade Contractor certifying that welders comply with requirements under the Trade Contractor's Quality Assurance article.

- G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- H. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3 and the following:
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
- B. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Gratings Manufacturer: A manufacturer specializing in the fabrication of the type of units required who has tested the units for load-bearing strength and deflection, and has currently published load tables based on recognized test procedures.

1.6 TRADE CONTRACTOR'S 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, "Structural Welding Code - Stainless Steel."
- C. ADA Compliant Grating Regulatory Requirements: 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.

1.7 PROJECT CONDITIONS

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

- B. Use only galvanized metal, aluminum, stainless steel or primed and finished material for metals exposed to non-conditioned spaces; or used at the exterior. Do not install non-protected steel for exterior locations.
- C. Provide galvanic protection for dissimilar metals as required in non-conditioned areas. "Non-conditioned areas" consists of any area outside of the weather/air barrier and roofing system.

1.8 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- 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 Ladders: Provide galvanized steel ladders as shown, designed and constructed to support a live load of 250 lbs. per rung.
 - 1. Provide steel galvanized steel landing platforms designed to support a live load of 100 lbf/ft.² and a concentrated load of 300 lbf.
- C. Wire Mesh used as equipment barriers including between elevators: 0.135-inch- (3.5-mm-) diameter, intermediate-crimp steel wire woven into 1-by-2-inch (25-by-50-mm) rectangular mesh.
 - 1. Panels: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3.2-mm) steel angle framing on four sides, with wire mesh welded to framing.
 - 2. Horizontal Panel Stiffeners: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3.2-mm) steel angles or 3/4-by-1/4-inch (19-by-6.4-mm) hot-rolled steel flat bars.
 - 3. Height: 48 inches (1220 mm).
 - 4. Line and Corner Posts: 2-by-2-by-0.068-inch (50-by-50-by-1.7-mm) steel tubing with steel base plates welded to bottoms, drilled for attachment to floor, and with steel caps welded to tops.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304 for interior use; type 316 for exterior exposure
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 for interior use, type 316 for exterior exposure.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: See Section 057500 for this item. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. IKG Industries, a division of Harsco Corporation; Mebac.
 - b. SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.
- F. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- H. Unistrut: engineered industrial plank floor panels. Noted as **MF-03**; shop galvanize before installing. Thickness: 18 gage before galvanizing; anti-skid surface, slotted.

2.3 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.4 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 (ASTM F 1941M), 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.

- 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. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Miscellaneous Fasteners:
 - 1. Eyebolts: ASTM A 489.
 - 2. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
 - 3. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
 - 4. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- G. 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, conducted by a qualified independent testing agency.
- H. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- I. 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).

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting." For items scheduled to have High Performance coatings applied as the finish coat, coordinate shop primers with Section 099600 "High Performance Coatings"
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Epoxy Zinc-Rich Primer: Complying with SSPC Paint 20 and compatible with topcoat.
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Carboline Company; Carbozinc 621.
 - b. ICI Devoe Coatings; Catha-Coat 313.
 - c. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- H. 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.
- I. 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).

2.6 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. Where tight corners are shown, score back of plate if it will not impair overall strength of the material. Comply with forming instructions where indicated on drawings.
- 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 will be 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.
 - 1. 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 (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.
- J. Hot dip galvanize exterior metal fabrications, interior metal fabrications embedded in concrete, installed in exterior wall and elsewhere as specified.
- K. Assure that finished galvanized surfaces are free of burrs, protruding bits of zinc, or other conditions that could cause snags to clothing. Make all surfaces smooth to the touch.

2.7 GRATINGS

- A. General: Provide galvanized steel gratings or aluminum gratings where indicated, including supplementary framing and supports. Verify depth of existing shelf supports at ADA compliant sidewalk gratings, and modify grating selection as required to fit depth of support, ADA compliant spacing, and loading criteria specified in "Performance Criteria" article.
- B. Provide gratings of pressure lock type construction, rectangular pattern, with plain surface top bars in the same plane; accurately fabricated free from warps, twists or other defects affecting their serviceability or appearance.
- C. Provide removable grating sections where shown, with end-banding bars for each panel and each opening, saddle clip anchors designed to fit over bearing bars, and stud bolts with washers and nuts, unless otherwise shown.

- D. Provide cutouts in grating sections for penetrations indicated. Edge band openings in grating that interrupt 4 or more bearing bars with bars of same size and material as bearing bars.
- E. Light Duty Gratings; Provide the following welded steel gratings:
 - 1. Grating Frame: Provide hot dipped galvanized steel frame in locations as shown, consisting of 2 inch x 2 inch x 1/4 inch thick steel angle continuously welded to a 1 inch x 1/2 inch steel bar with anchors welded to backs of angles at 2 ft. centers with a minimum of eight (8) anchors per unit.
 - 2. Grating: "11-W-4" (Ohio Gratings); 1 inch x 3/16 inch bars spaced 11/16 inch on center with 3/8 inch diameter cross bars spaced 4 inches on center for grilles, held down with recessed lock down anchors to grating frame embedded in concrete surround. Entire assembly shall withstand performance loads specified in Performance Criteria.

2.8 ROOF TIE-OFF SYSTEM

- A. Provide permanent roof anchor point, cables, tensioners, connectors and all accessories for an OSHA approved safety tie-off system.
- B. Provide shock absorbers at all cables so that load at center of each span is no more than 5000 pounds.
- C. Anchors: install at locations where shown on the drawings. 12" height, anchored to roof structure. Provide universal base plate, stainless steel construction; with eyes for use with horizontal lifeline. Size: 12" post with 16" x 16" baseplate.
- D. Tie off system Basis of Design: Miller by Sperian "Xenon Permanent Horizontal Lifeline System"
 - 1. Components: provide anchors, shock absorbers, cable fittings, shackles and support brackets as needed to contain cable movement.
 - 2. Cable: 5/16" diameter stainless steel aircraft cable with sufficient strength to support 5000 pound load at center point.
- E. Provide lanyards and shuttles to connect to horizontal lifeline. Provide instruction to Owner's personnel.
- F. Provide 6 personnel harnesses with system.

2.9 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. Fabricate units from slotted channel framing where indicated.

2. Furnish inserts for units installed after concrete is placed.
- C. Steel Tube Supports for Countertops: Utilize steel tube supports sized to support dead loads of countertops, and in addition a uniform live load of 300 psf (14.4 kPa). Where exposed in the finish work, provide welded connections, ground smooth and primed for field painting specified in Section, "Interior Painting". Where concealed, utilize bolts and connectors of capacity required to support imposed live and dead loads. Anchor steel tubes to structural walls and slabs as required for a secure and rigid installations. Fasten tubes to countertops with fasteners applied through the tubes into the underside of tops, and in sufficient quantity for a secure installation.
- D. Framing For Toilet Compartments
1. Provide continuous steel framing for toilet partition supports, coordinated with the toilet partitions and including provisions for partition anchorage as required to sustain imposed loads and to limit deflections to $L/360$ between hangers.
 2. Provide steel rods, 1/2 in. (13mm) dia., spaced not more than 36 in. (900mm) o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge shape washers for full bearing on sloping flanges of support beam.
 3. Coordinate installation with toilet partition manufacturer's written instructions and recommendations.
- E. Galvanize miscellaneous framing and supports where indicated.
- F. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.10 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames for coiling overhead doors, from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.
 - 1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- C. Hot dip galvanize exterior steel frames.

2.12 METAL LADDERS **including those** Noted as MF-04 for roof ladders

- A. General:
 - 1. Comply with ANSI A14.3 except for pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
 - 1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
 - 2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
 - 3. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
 - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - ~~5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.~~
 - ~~6-5.~~ Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) IKG Industries, a division of Harsco Corporation; Mebac.
 - 2) SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.
 - ~~7-6.~~ Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
 - ~~8-7.~~ Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 - ~~9-8.~~ Galvanize exterior ladders, including brackets and fasteners.
 - ~~10-9.~~ Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

- ~~11~~10. Railings and railing welds shall be finished smooth and free of all burrs, rough edges, or other protrusions that would cause injury to a bare hand prior after galvanizing.

2.13 LADDER SAFETY CAGES

A. General:

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet (6 m) o.c. Provide secondary intermediate hoops spaced not more than 48 inches (1200 mm) o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.

B. Steel Ladder Safety Cages:

1. Primary Hoops: 1/4-by-4-inch (6.4-by-100-mm) flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch (6.4-by-50-mm) flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch (4.8-by-38-mm) flat bars secured to each hoop.
4. Galvanize exterior ladder safety cages, including brackets and fasteners.
5. Prime ladder safety cages, including brackets and fasteners, with zinc-rich primer.

2.14 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim and interior trim used in wet areas.
- D. Prime interior miscellaneous steel trim with zinc-rich primer if not galvanized.

2.15 METAL BOLLARDS

- A. Metal bollards used at back of house locations:
 1. Fabricate metal bollards from Schedule 80 steel pipe.
 - a. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate.
 - b. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.

- c. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
 2. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.
 3. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness steel tubing with an OD approximately 1/16 inch (1.5 mm) less than ID of bollards. Match drill sleeve and bollard for 3/4 inch (19 mm) steel machine bolt.
 4. Galvanize exterior bollards.
 5. Prime interior bollards with zinc-rich primer.
- B. Metal bollards used at building entry:
1. Basis of design: Wikk "INGRESS'R" stainless steel bollard with full height push plate. Model No. 136-5 US32D. 6" wide by 36" tall.
 2. Material: Type 304 stainless, 18 gage
 3. Provide push plate with universal symbol of accessibility. Access plate size: 36" high by 2-1/2 inches
 4. Provide touch-activated door controls
 5. Coordinate with door entry at building entry locations.
 6. Coordinate wiring location with electrical access.
 7. Provide footing for exterior mounting

2.16 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize exterior plates.
- C. Shop Prime interior plates with zinc-rich primer.

2.17 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 (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in interior walls with zinc-rich primer.

2.18 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.

2.19 FABRICATION TOLERANCES

- A. Squareness: 1/8-inch maximum difference in diagonal measurements.
- B. Maximum offset between components at joints: 1/16-inch except that at welded joints no offset is allowed.
- C. Maximum misalignment of adjacent members: 1/16-inch.
- D. Maximum bow: 1/8-inch in 48 inches.
- E. Maximum deviation from plane: 1/16-inch in 48 inches.
- F. Grind as required to achieve desired results if necessary

2.20 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.21 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. 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 universal shop primer unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

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 Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. 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.
- E. Powder-Coated Finish for Non-Galvanized Metal: Prepare, treat, and coat non-galvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6, "Commercial Blast Cleaning."
 2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
- F. Powder-Coated Finish for Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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.

- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

3.3 PREPARATION

- A. Substrate Acceptability: Commencement of installation shall constitute acceptance of substrate conditions by the Installer

3.4 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.
 - 5. All welds and fitment must be accepted by Owner's Testing Agency.
- 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.
- F. Install roof anchors at locations shown on the drawings, and attach to structure.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.5 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.
- B. Anchor supports for ceiling hung toilet partitions, overhead doors and overhead grilles securely to and rigidly brace from building structure.

3.6 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing welding metal cap.
 - 1. Do not fill removable bollards with concrete.
- B. Anchor non-moving bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
- C. Anchor internal sleeves for removable bollards in concrete by inserting into pipe sleeves preset into concrete. Fill annular space around internal sleeves solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward internal sleeve.
- D. Coordinate power, electrical and communications for bollards that contain access devices.

3.7 INSTALLING LADDERS

- A. Vertical Ladders, Industrial Type Ladders Provide vertical ladders, industrial type ladders at all locations requiring access to equipment, catwalks or gratings.
- B. Securing Vertical Ladders: Secure vertical ladders to masonry or concrete with a minimum of two 1/2 in. diameter expansion bolts at each bracket, unless additional attachments are required to sustain imposed loads. At walls with cold formed metal panels, provide metal plate backup and anchor vertical ladders to metal plate reinforcement.

3.8 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.9 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 (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780, Annex A2.

END OF SECTION 05 50 10

PROJECT SPECIFICATION

SECTION 06 64 00

PLASTIC PANELING

SALT LAKE CITY INTERNATIONAL AIRPORT

2	01.07.20	FCR 00666
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 06 64 00 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire rated plastic sheet paneling used for wall protection in back of house areas.
 - 2. Phenolic panels used for wall protection in public areas.
 - 3. Ballistic rated panels used in wall construction and casework.
 - 4. All accessories used for mounting

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants used at Project site, documentation including printed statement of VOC content showing credit compliance.
 - 2. Product Data for Credit IEQ 4.2: For paints and coatings used at Project site, documentation including printed statement of VOC content showing credit compliance.
 - 3. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.
- C. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes. Submit samples of all trim pieces used for phenolic panels.
- D. Submit data sheets showing fire rating of panels and accessories.
- E. Maintenance Materials: See Division 01 Section 017486 Extra Stock Materials for requirements related to this section,

1.4 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.

- B. Mockup: Provide mockup of first installation of Compact Laminate panels (“Phenolic”) in a size at least full wall height by 10 feet long, and going around one corner. Show joints between panels, outside corner; and vertical edge joints at panel edges. After approval, mockup may be left in place and remain part of final installation.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
 - 1. Basis of design is Marlite FRP Class 1/A. Color: S-100G “White” smooth or as indicated on finish materials schedule.
 - 2. Products from the following are considerable comparable products:
 - a. Crane Composites “Glasbord Class A”
 - b. Glasteel “Glasteel Class A”
 - c. Nudo “FiberLite Class A”
 - 3. Wall materials shall comply with the 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. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 5. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
 - 6. Surface Finish: Smooth.
 - 7. Color: As selected by Architect from manufacturer's full range.
- B. Compact Laminate (noted as “Phenolic” on the drawings) panels used for wall protection:

1. Basis of Design: Trespa “Virtuon” High pressure compact laminate product. See Finish Materials Schedule for location of panel types.
2. Other Manufacturers: Formica “Compact” high pressure laminate product.
3. See 090000 for color selections, items PP51, PP52, and PP55
4. Wall materials shall comply with the 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."
5. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
6. Nominal Thickness: 3/8 inch.
7. Surface Finish: Smooth. Ease all edges
8. Color: As selected by Architect from manufacturer's full range.
9. Mounting hardware: clips and standoffs.
 - a. WRS Panel systems shapes and hardware. System: 3/8” “Shadowline”
 - b. SS brake-metal corner piece
 - c. Bottom edge details
 - d. Panel clips GEN-017
 - e. Edge trim SHA-101
 - f. Variable inside corner pieces
 - g. Variable outside corners
 - h. Vertical edge details
 - i. Edge radius: SHA-102
 - j. Vertical spline joint SHA-110
 - k. Vertical spline joint SHA-112
 - l. Horizontal joint SHA-120 and SHA-122
 - m. Outside Corner SHA-130, SHA-131 and SHA 132 plus 20 gage stainless steel corner guard piece where shown on the drawings
 - n. Use fasteners recommended as part of system.

C. Ballistic rated panels used in walls :

1. Ballistics rating: Level 8 UL 752, Level III NIJ . Resistant to 7.62 mm rifle, 150 grain size at 2700 ft/sec.
2. Fiberglass composite panels: Armortex “opaque fiberglass” ballistic grade fiberglass panels. Product #O.F. 800; Nominal thickness 1-7/16”; weight 16 lb/square foot.
3. Kevlar panels: ArmorCo “Spectra/Dyneema” fiberglass ballistic panels. Nominal thickness: 0.95 inch. Weight: 4.5 pounds per square foot; thermo formed.
4. Installation: install in wall construction construction where noted on the drawings; install using manufacturer’s recommended fasteners with all accessories necessary for secure installation.

2.3 ACCESSORIES

- A. Trim Accessories for Glass Fiber Panels: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
 - 2. Basis of design: "Sani-Seal" trim pieces. Provide Inside corner, Outside corner, Edge and Panel seam piece called "Division".
 - 3. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- B. Trim Accessories for phenolic panels: See listing in 2.2B.9 above.
 - 1. Adhesive 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. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.

2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION OF FIBERGLASS PROTECTIVE PANELS

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive and staples. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant and apply batten at joints.
- G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.4 INSTALLATION OF PHENOLIC PANELS

- A. Install clips and trim pieces as shown on the elevations. Align panels so that vertical and horizontal joints are level and plumb; align panel corners when installing. Total installed thickness of system: 1" from face of wall; maintain air space behind panels away from gypsum board substrate.

3.5 INSTALLATION OF BALLISTIC RATED PANELS

- A. Install bullet resistant panels as part of wall construction in selected areas scheduled on drawings. Use long lengths as possible for conditions of installation. Use fasteners and installation methods approved by panel manufacturer to maintain appropriate rating.

END OF SECTION

PROJECT SPECIFICATION

SECTION 07 84 13

PENETRATION FIRESTOPPING

SALT LAKE CITY INTERNATIONAL AIRPORT

2	01.04.19	Bulletin 26
1	05.13. 2016	Issue For Construction
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SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.
- B. Related Sections:
 - 1. Section 078446 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors,"

OR

- B. **Installer Qualifications: a firm that has been** ~~or been~~ evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

~~A.~~ OR

- C. Installer Qualifications: A firm experienced in installing penetration 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. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1. The manufacturer of the selected firestopping materials must perform the following:

- a. **Annual audits of the installer by the manufacturer, demonstrating their compliance with installation requirements.**
- b. **Training by a Senior Fire Protection Specialist provided by the manufacturer for the installers on the project.**
- c. **Periodic visits to the job site to ensure that the installed systems meet the UL requirements and the manufacturer requirements for the assembly.**

~~B.~~

- ~~C.~~ **D.** Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

- 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
- 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
- b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."

~~D.~~**E.** Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide **all** products **used on the project** by **only** one of the following **manufacturers**:
 - 1. A/D Fire Protection Systems Inc.
 - 2. Grace Construction Products.
 - 3. Hilti, Inc.
 - 4. Johns Manville.
 - 5. RectorSeal Corporation.
 - 6. Specified Technologies Inc.
 - 7. 3M Fire Protection Products.
 - 8. Tremco, Inc.; Tremco Fire Protection Systems Group.

9. USG Corporation.

2.2 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: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. Fire-resistance-rated walls include fire walls fire-barrier walls smoke-barrier walls and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. 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 Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. 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.
- G. 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.

- H. 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."
- I. 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.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.

- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings **and to conform with shop drawings and listed assemblies** for products and applications indicated.
- B. 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.
- C. 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.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within **6 inches (150 mm)** 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.

3.5 FIELD QUALITY CONTROL

- A. CMAR 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.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION

PROJECT SPECIFICATION

SECTION 07 84 46

FIRE RESISTIVE JOINT SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

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1	05.13.16	Issue For Construction
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SECTION 07 84 46 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fire-resistive joint systems for the following:
 - 1. Perimeter head of wall and floor joints.
- B. Related Sections include the following:
 - 1. Division 7 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
 - 2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.2 PERFORMANCE REQUIREMENTS

- A. Fire resistive joint systems indicated on the Drawings are based on design conditions. Contractor's selection of fire resistive joint systems shall be suitable for the field conditions based on the actual size, location and materials of the penetrants.
 - 1. Submit a UL tested and listed assembly sheet identical to each field condition, so that installed fire resistive joints are identical to tested assemblies.
 - 2. For conditions that do not have a UL listed and tested assembly sheet, employ a fire protection engineer capable of submitting an engineering judgment for the review and acceptance of the Owner's independent inspection agency.
 - 3. Provide fire resistive joint materials which are non-toxic, non-hazardous, do not contain asbestos fibers or dust particles nor other substance prohibited by law, and do not require hazardous waste disposal of used containers.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E1966 or UL 2079:
 - 1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies, and roofs or roof/ceiling assemblies.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
- C. General: Provide fire-resistive joint systems that are 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 assembly in which fire-resistive joint systems are installed.
- D. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, with movement capabilities indicated as determined by UL 2079.

- E. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- D. Qualification Data: For Installer.
- E. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
- F. LEED Submittals;
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants used at Project site, documentation including printed statement of VOC content showing credit compliance.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

OR

- B. **Installer Qualifications: a firm that has been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."**

OR

- C. **Installer Qualifications: A firm experienced in installing penetration 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. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified**

requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1. The manufacturer of the selected firestopping materials must perform the following:
 - a. Annual audits of the installer by the manufacturer, demonstrating their compliance with installation requirements.
 - b. Training by a Senior Fire Protection Specialist provided by the manufacturer for the installers on the project.
 - c. Periodic visits to the job site to ensure that the installed systems meet the UL requirements and the manufacturer requirements for the assembly.

~~A.~~

~~B.D.~~ Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

~~C.E.~~ Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

~~D.F.~~ Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are 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 assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases. **Subject to compliance with requirement, provide all products used on the project by only one of the following listed manufacturers.**
- B. 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.
 - 2. 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. Grace Construction Products. www.na.graceconstruction.com
 - b. Hilti, Inc. www.hilti.com
 - c. 3M Fire Protection Products.
www.solutions.3m.com/wps/portal/3M/en_US/Fire_Protection_Products

- C. Joints at Exterior Curtain-Wall/Floor Intersections: Noted as **INS-05** Rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307. Basis of design: Hilti Perimeter Fire Barrier System # CEJ 425 P (HI/BP 120-04) or STI #CW-S-0001, CW-S-2047 & 2048 similar at Floor.
- D. Mineral wool insulation and smoke stop seals at Perimeter Fire Safing located at slab edges behind MCM panels: noted as **INS-10**. Mineral Wool must be 4 pcf.
1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 2. 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. Grace Construction Products. www.na.graceconstruction.com
 - b. Hilti, Inc. www.hilti.com
 - c. 3M Fire Protection Products.
www.solutions.3m.com/wps/portal/3M/en_US/Fire_Protection_Products
- E. 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. 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. Grace Construction Products. www.na.graceconstruction.com
 - b. Hilti, Inc. www.hilti.com
 - c. 3M Fire Protection Products.
www.solutions.3m.com/wps/portal/3M/en_US/Fire_Protection_Products
- F. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.
- H. Low Emitting Materials: Adhesives, Sealants and Sealant Primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168. Volatile organic compound (VOC) limits listed in the table below correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.2 IDENTIFICATION

- A. Identify fire-resistive joint 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-Resistive 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.

3.3 FIELD QUALITY CONTROL

- A. Inspecting Agency: CMAR will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.4 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.
- B. Head-of-Wall Fire-Resistive Joint Systems:
 - 1. Assembly Rating: as indicated.
 - 2. Nominal Joint Width: As indicated, or if not indicated, as verified in field.
 - 3. Provide UL classified, fire-rated joint system best suited for each applicable head-of-wall condition as per recommendations of fire-resistive joint system manufacturer and as required by code. Obtain Architect's approval for all selections.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal doors and frames, in solid and glazed configurations.
- B. See Division 09 Section “High Performance Coatings” for field finish painting.
- C. See Division 08 Section “Glazing” for glass in hollow metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8

1.4 COORDINATION

- A. Coordinate anchorage installation 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.
- B. Coordinate installation and activation of the security system with the hollow metal doors and frames as required.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Meetings: Conduct conferences at Project site.

1.6 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
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 each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
 - a. Coordinate glazing frames and stops with glass and glazing requirements.
9. Details of conduit and preparations for power, signal, and control systems.
 - a. Electric Hardware and Devices: Indicate routing of electrical conduit for electric hardware and devices.
 - b. Security System Components: Indicate all cutouts required to steel door and frame components to accept security system components.

C. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing dimensions, locations of door hardware, and preparations for power, signal, and control systems

D. Sustainable Design Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Certificates for Credit MR 5: For products and materials that comply with requirements for regionally manufactured and regionally extracted and manufactured materials. Include statement indicating cost for each regionally manufactured material.
3. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content showing credit compliance.

E. Samples for Initial Selection: For units with factory-applied color finishes.

F. Samples for Verification:

1. Prepare Samples approximately 8 by 10 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

- G. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
- H. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- I. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 TRADE CONTRACTOR'S QUALITY CONTROL

- A. Manufacturer Qualifications: A member of the Steel Door Institute (SDI).
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Use only vented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating custom steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.10 COORDINATION

- A. Coordinate installation of anchorages for custom steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following members of the Steel Door Institute (SDI):
1. Ceco Door Products; an Assa Abloy Group company. (Basis of Design [Trio-E Energy Efficient Steel Stiffened Door](#))
 2. Pioneer Industries, Inc.
 3. Republic Doors and Frames.
 4. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: [Alternate manufacturers are acceptable but must be reviewed by Owner and Architect prior to approval](#)—~~Obtain hollow metal work from single source from single manufacturer.~~

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: SDI A250.8, Level 1. At locations indicated in the Door and Frame Schedule.
1. Physical Performance: Level B according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).

- c. Face: Metallic-coated, cold-rolled steel sheet, 18ga. face sheets, minimum thickness of 0.042 inch (0.8 mm) unless otherwise noted on door schedule. ~~Door schedule indicates gage thickness.~~ Manufacturer shall provide closest thickness that is gage equivalent as per NAAMM.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Exposed finish: Prime
3. Frames:
- a. Materials: Metallic-coated steel sheet, minimum thickness of .053 (1.3 mm) unless otherwise noted on door schedule. Door schedule indicates gage thickness. Manufacturer shall provide closest thickness that is gage equivalent as per NAAMM.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES Noted as SD-01 and SD-02

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
- 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - d. Selected doors are .067 (1.7 mm) and .093 (2.3 mm); see door schedule. Provide A40 coating.
 - e. Edge Construction: Model 1, Full Flush.
 - f. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - g. Finish: factory prime
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A60 (ZF180) coating.
 - b. Selected door frames are minimum thickness .093 (2.3mm); see schedule. Provide A60 coating.
 - c. Construction: Full profile welded.
 - d. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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 hollow-metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M. Use only at CMU or concrete walls.

- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Polystyrene core: standard to the manufacturer for the insulation value required.
- K. Glazing: Comply with requirements in Division 08 Section "Interior Glazing."

2.7 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 metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. ~~Spot weld to face sheets no more than 5 inches (127 mm) o.c.~~ Face sheets to be chemically bonded to all interior surfaces Fill spaces between stiffeners with polyurethane ~~glass or mineral fiber~~ insulation.
 - 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 - 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: 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.
 - 1. 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.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

3. Coordinate cutouts and placement for all security conduits, connections and placement of security hardware as indicated on the approved shop drawings.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 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 embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 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. Do not remove factory installed shipping spreaders until frame is set and secured in the opening.
- C. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames at rated and/or insulated walls. Non-rated or non-insulated walls do not require frames to be filled.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout. Dry pack grout before installing frame.
 - 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

D. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

- a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
- b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
- c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
- d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

E. Glazing: Comply with installation requirements in Section "Interior Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 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. Factory Prime Touchup: Clean abraded areas and repair with same material used for factory prime according to manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

PROJECT SPECIFICATION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

SALT LAKE CITY INTERNATIONAL AIRPORT

<u>4</u>	<u>01.04.19</u>	<u>Bulletin 26</u>
3	05.05.18	Bulletin 17
2	08.18.16	Bulletin 01
1	05.13.16	Issue for Construction
REV.	DATE	ISSUANCE

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal doors and frames.
- B. See Division 09 Section "High Performance Coatings" for field finish painting.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8

1.4 COORDINATION

- A. Coordinate anchorage installation 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.
- B. Coordinate installation and activation of the security system with the hollow metal doors and frames as required.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Meetings: Conduct conferences at Project site.

1.6 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:

1. Elevations of each door type.
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 each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
 - a. Coordinate glazing frames and stops with glass and glazing requirements.
9. Details of conduit and preparations for power, signal, and control systems.
 - a. Electric Hardware and Devices: Indicate routing of electrical conduit for electric hardware and devices.
 - b. Security System Components: Indicate all cutouts required to steel door and frame components to accept security system components.
- C. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing dimensions, locations of door hardware, and preparations for power, signal, and control systems
- D. Sustainable Design Submittals:
 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 2. Product Certificates for Credit MR 5: For products and materials that comply with requirements for regionally manufactured and regionally extracted and manufactured materials. Include statement indicating cost for each regionally manufactured material.
 3. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content showing credit compliance.
- E. Samples for Initial Selection: For units with factory-applied color finishes.
- F. Samples for Verification:
 1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
 2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 8 by 10 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

- G. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
- H. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- I. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 TRADE CONTRACTOR'S QUALITY CONTROL

- A. Manufacturer Qualifications: A member of the Steel Door Institute (SDI).
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Use only vented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating custom steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.10 COORDINATION

- A. Coordinate installation of anchorages for custom steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following members of the Steel Door Institute (SDI):
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Pioneer Industries, Inc.
 - 3. Republic Doors and Frames.
 - 4. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: SDI A250.8, Level 1. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.042 inch (0.8 mm) unless otherwise noted on door schedule. Door schedule indicates gage

- thickness. Manufacturer shall provide closest thickness that is gage equivalent as per NAAMM.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Exposed finish: Prime
3. Frames:
- a. Materials: Metallic-coated steel sheet, minimum thickness of .053 (1.3 mm) unless otherwise noted on door schedule. Door schedule indicates gage thickness. Manufacturer shall provide closest thickness that is gage equivalent as per NAAMM.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
- 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
- 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.5 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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 hollow-metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Polystyrene core: standard to the manufacturer for the insulation value required.
- K. Glazing: Comply with requirements in Division 08 Section "Interior Glazing."
- L. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities. Use for all doors installed in concrete, CMU, and plaster walls and for all doors installed in exterior walls or walls leading to non-conditioned spaces.

2.6 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 metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.

3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: 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.
1. 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.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - c. Compression Type: Not less than two anchors in each frame.

- d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
- 6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
- 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 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 embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Provide site bracing as needed to install doors square and plumb.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 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. Do not remove factory installed shipping spreaders until frame is set and secured in the opening.~~

C.B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 as required by standards specified.

- 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames at rated and/or insulated walls. Non-rated or non-insulated walls do not require frames to be filled.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

D.C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
 - c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
 - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

E.D. Glazing: Comply with installation requirements in Section "Interior Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 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. Factory Prime Touchup: Clean abraded areas and repair with same material used for factory prime according to manufacturer's written instructions.

- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

PROJECT SPECIFICATION

SECTION 09 21 18

GYPSUM BOARD ASSEMBLIES

SALT LAKE CITY INTERNATIONAL AIRPORT

3	04.15.21	Bulletin 39
2	12.15.16	Bulletin 03
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 09 21 18 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Nonload-bearing steel framing members for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
 - 3. Mold and mildew resistant interior gypsum board panels attached to steel framing.
 - 4. Typical fire rated interior gypsum board panels
 - 5. Reinforcing mesh inside walls for security at selected areas.
- B. Related Requirements:
 - 1. For patch and repair of existing work, see Division 01 Section Alteration Project Procedures
- C. Nomenclature: Framing products provided under this Section are indicated on the Drawings as "steel studs"

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Meeting: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures for installing work related to gypsum board assemblies including, but not limited to, the following:
 - 1. Fasteners proposed for anchoring steel framing to building structure.
 - 2. Sprayed fire-resistive materials applied to structural framing.
 - 3. Wiring devices in gypsum board assemblies.
 - 4. Doors and other items penetrating gypsum board assemblies.
 - 5. Items supported by gypsum board assembly framing.
 - 6. Locations of mesh in wall board assemblies.

7. Mechanical work enclosed within gypsum board assemblies.
8. Ceiling assembly construction when required for lateral support of partitions.

1.5 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. LEED Submittals:
 1. Product Data for Credit MR 3: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 2. Product Certificates for Credit MR3: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
 3. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material.
 - a. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.
 - b. Include statement indicating location of manufacturer and point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials. Indicate distance to Project and fraction by weight of each regionally manufactured material that is regionally extracted.
 4. Product Data for Credit IEQ 4: For sealants, documentation including printed statement of VOC content.
- C. Shop Drawings showing locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- D. Samples: For the following products:
 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
- E. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 1. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; access panels; and special moldings at walls, column penetrations, and other junctures of gypsum board ceilings with adjoining construction.
 2. Minimum Drawing Scale: 1/4 inch = 1 foot (1:48).

- F. Interior Ticket Canopy Coordination Drawings: provide reflected ceiling plans and detail sections drawn to scale and showing coordination between penetrations and ceiling mounted items: Show the following
 - a. Ceiling mounted items including light fixtures; camera; speakers; sprinklers; access to low voltage cabling; primary and second structural elements including light gage metal shapes; moldings, penetrations and other junctures of gypsum board ceiling with adjoining construction.
 - b. Minimum drawing scale: ½ inch = 1 foot.

1.6 TRADE CONTRACTOR QUALITY ASSURANCE

- A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.
- B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal trim and framing components.
- D. Store and handle gypsum panels in a manner to prevent mold growth on panels.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: The following performance criteria have been used in the selection and design of the interior wall assemblies. Studs were selected based on this criteria and using the Steel Stud Manufacturer's Association and other manufacturer's span tables.
 - 1. Unless otherwise indicated, install gypsum board assemblies to ensure that the completed assembly withstands a minimum positive and negative pressure of 5 lbf/sq. ft. (239 Pa) normal to the plane of the wall.
 - 2. Deflection Limits: framing systems are designed to withstand design loads without deflections greater than the following:
 - a. Interior Nonload-Bearing Wall Framing with Indicated Panels:
 - 1) With Standard Gypsum Board: Horizontal deflection of 1/240 of the wall height under dead load and a minimum positive and negative pressure of 5 lbf/sq. ft. (239 Pa).
 - 2) With Tile backing panels Scheduled to Receive typical Ceramic Tile Finishes: Horizontal deflection of L/360 of the wall height under dead load and a minimum positive and negative pressure of 5 lbf/sq. ft. (239 Pa).
 - 3) With Tile Backing Panels scheduled to receive Large format tile finish (tile greater than 15" on any side): Horizontal deflection of L/480 of the wall height under dead load and a minimum positive and negative pressure of 5 lbf/sq. ft. (239 Pa).
 - b. Ceiling Joist Framing with Standard Gypsum Board: Vertical deflection of 1/360 of the span of the greatest ceiling dimension under dead load and a vertical live load of 10 lbf/sq. ft. (478 Pa).

3. . For Shaft Wall Assemblies, See Division 09 Section "Gypsum Board Shaft Wall Assemblies".
- B. Seismic Performance: Acoustical ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Wall Identification: Permanently label fire rated walls with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76mm) high and with minimum 0.375-inch (10 mm) strokes.
 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- D. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."
 2. Fire-Resistance Rating: 2 hours, unless otherwise indicated on the Drawings .
- E. 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.
 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
 2. STC Rating: As indicated.

2.2 STEEL FRAMING SYSTEMS FOR WALLS AND PARTITIONS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated and with maximum deflection conditions specified under Article "Performance Requirements."
 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. In areas where top of partitions are dependent on ceiling system for lateral support, coordinate design and installation to comply with the above deflection limitations.
 3. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645.
 1. Steel Studs and Runners:
 - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) CEMCO; California Expanded Metal Products Co.
 - 2) MBA Building Supplies.
 - 3) MRI Steel Framing, LLC.
 - 4) Phillips Manufacturing Co.
 - 5) Steel Network, Inc. (The).
 - b. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm). See wall schedule for all thicknesses. Thickness is base metal before galvanizing.
 2. Depth: 3-5/8 inches (92 mm) or as noted on wall schedule. Heavier gage Steel studs and runners: conform to SSMA manual for studs greater than 54 mil thickness. Provide studs conforming AISI S100 and all studs greater than 54 mil shall have 50 ksi yield. Provide matching runner.
- D. Attachments to Concrete Floor: As follows:
1. Power-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- E. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) ClarkDietrich Building Systems Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; Slotted Deflecto Track.
 - 3) Steel Network Inc. (The); VertiTrack VTD Series.
- F. Intumescent slip-type head joints: Where indicated, provide ClarkDietrich Building Systems "BlazeFrame Fire Stop Deflection Track" capable of 3" total movement or as shown on the drawings. See wall assemblies for required fire rating.
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base Metal Thickness: 0.0538-inch (1.367-mm), sized as required to fasten to studs for supporting wall mounted fixtures, equipment or as required for attachment to other work.
 2. At partitions indicated to support gravity and pullout loads of imposed fixtures, equipment, services, heavy trim, furnishings and similar work, provide additional framing, blocking and bracing support within partitions. Where floor to floor limiting heights are exceeded, provide additional bracing at midpoint of wall. Provide additional support when regular framing of gypsum board shaft wall system is inadequate to support imposed loads directly.

3. Wall hung items: backing strapping must span a minimum of three studs; for longer items, backing strapping must extend one stud width in each direction past the end of the wall mounted item.
- H. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges. Provide channel bridging as required.
 1. Depth: 1-1/2 inches (38 mm) unless otherwise indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- I. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
 2. Depth: 7/8 inch (22.2 mm) unless otherwise indicated on Drawings.
- J. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.
- K. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 0.053-inch (1.34-mm) wide flanges.
 1. Depth: 0.053-inch (1.34-mm) unless otherwise indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire
- L. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.

2.3 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

- A. Steel Framing Members: Provide components complying with ASTM C 754 for conditions indicated.
 1. Protective Coating: ASTM A653, G 40 (ASTM A653M, Z 90) hot-dip galvanized coating.
- B. Tie Wire: STM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- C. Hanger Attachments to Concrete:

1. Expansion Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488/E488M by an independent testing agency.
 - a. Type: Postinstalled, chemical anchor or Postinstalled, expansion anchor.
 2. Power-Actuated Fasteners: Power-actuated fasteners are prohibited for ceiling substrates on any part of the project.
- D. Wire Hangers: ASTM A641/ASTM A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) diameter.
- E. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated unless otherwise indicated on Drawings.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 GYPSUM BOARD PRODUCTS

- A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).

2.5 INTERIOR GYPSUM BOARD

- A. Panel Material Requirements: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
1. Provide auxiliary materials complying with gypsum board manufacturer's written recommendations.
- B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- C. Gypsum Wallboard: Noted as **GWB-50**. ASTM C 1396/C 1396M.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; ProRoc Regular.
 - b. Georgia-Pacific Building Products; ToughRock Gypsum Board
 - c. National Gypsum Company; Gold Bond Brand Gypsum Wallboard.

- d. United States Gypsum Company; USG Sheetrock® Brand Gypsum Panels.
 2. Thickness: 1/2 inch (12.7 mm).
 3. Long Edges: Tapered.
 4. Used at built out walls for increased depth.
- D. Gypsum Board, Type X: Noted as **GWB-51**. ASTM C1396 or ASTM C1658:
 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation, ProRoc Regular Gypsum Board, Type X.
 - b. Georgia-Pacific Gypsum LLC, ToughRock Fireguard X
 - c. National Gypsum Company; Gold Bond Fire-Shield Wallboard.
 - d. USG Corporation, Sheetrock Gypsum Panels, Firecode.
 2. Thickness: 5/8 inch (15.9 mm).
 3. Long Edges: Tapered.
- E. Mold and Mildew Resistant Gypsum Board: Noted as **GWB-54**: ASTM C 1396/C 1396M or ASTM C 1658/C 1658M with moisture- and mold-resistant core and surfaces.
 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation, ProRoc Moisture & Mold Resistant Type X.
 - b. Georgia-Pacific Gypsum LLC, DensArmor Plus Fireguard Panels.
 - c. National Gypsum Company; Gold Bond Brand XP Fire-Shield Wallboard.
 - d. USG Corporation, Sheetrock Brand Gypsum Panels, Mold Tough AR Firecode
 2. Core: 5/8 inch (15.9 mm), Type X.
 3. Long Edges: Tapered.
 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 5. Location: interior partitions in damp, or unconditioned spaces.
- F. Abuse-Resistant Gypsum Board: High density, fire resistant, type X core, with heavy face paper that is highly resistant to scuffing, tested in accordance with ASTM C1629/C1629M. Noted as **GWB- 52**
 1. Product: Subject to compliance with requirements, provide the following or comparable product by one of the named manufacturers:
 - a. CertainTeed Corporation, ProRoc Abuse Resistant Type X.
 - b. Georgia-Pacific Gypsum LLC, DensArmor Plus Fireguard Abuse-Resistant Panel.
 - c. National Gypsum Company, Hi-Abuse XP Wallboard.
 - d. USG Corporation, Sheetrock Brand Gypsum Panels, Mold Tough AR Firecode.
 2. Core: 5/8 inch (15.9 mm), Type X.
 3. Long Edges: Tapered.
 4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- G. Impact-Resistant Gypsum Board Noted as **GWB-53**: High density, fire resistant, type X core, reinforced with a fiberglass mesh to provide impact/penetration resistance in accordance with ASTM C1629/C1629M, Level 2.
 1. Product: Subject to compliance with requirements, provide the following or comparable product by one of the named manufacturers:
 - a. CertainTeed Corporation, Extreme Impact Resistant Type X.
 - b. Georgia-Pacific Gypsum LLC, DensArmor Plus Fireguard Impact Resistant Panel.

- c. National Gypsum Company, Hi Impact XP Wallboard.
 - d. USG Corporation, Sheetrock Brand Gypsum Panels, Very High Impact Fire code.
 2. Core: 5/8 inch (15.9 mm), Type X.
 3. Long Edges: Tapered.
 4. Location: Dry interior gypsum board partitions in cores surrounding stair wells and elevator shafts that are not enclosed with shaftwall or CMU.
- H. Impact-Resistant Gypsum Board Noted as **GWB-55**: High density, reinforced with a fiberglass mesh to provide impact/penetration resistance in accordance with ASTM C1629/C1629M, Level 2 or 3.
1. Product: Subject to compliance with requirements, provide the following or comparable product by one of the named manufacturers:
 - a. CertainTeed Corporation, Abuse Resistant Type C
 - b. Georgia-Pacific Gypsum LLC, DensArmor Plus .
 2. Core: 1/2 inch (12 mm),
 3. Long Edges: Tapered.
 4. Location: used as top layer at Boarding areas where noted.

2.6 TILE BACKING PANELS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or C1325, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - b. National Gypsum Company, PermaBase Cement Board.
 - c. USG Corporation; DUROCK Cement Board.
 2. Thickness: 1/2 inch (12 mm).
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
 4. Locations: Install on walls and ceilings in areas subject to direct wetting such as showers where final finish is ceramic tile. Comply with installation requirements of ANSI A108.11. May also be installed in other areas not subject to direct wetting where ceramic tile is the final finish.
- C. Tile backer board, gypsum based: comply with ASTM C1178 for boards, and a mold resistance score of 10 per ASTM D3273.
1. Products: subject to compliance with requirements, provide one of the following:
 - a. USG: Durock Glass Mat tile backerboard. Use Durock Waterproofing membrane at all penetrations and seams.
 - b. GP (Georgia Pacific): Denshield Tile backer (contains integral moisture barrier)
 - c. National Gypsum: Gold Bond eXP Tile backer (contains integral moisture barrier)
 - d. CertainTeed : Diamondback GlasRoc (contains integral moisture barrier)
 2. Thickness: see details. 5/8" and 1/2". See wall types.
 3. Locations: install on walls and ceilings in areas not subject to direct wetting, such as toilet rooms and other locations where the final finish is ceramic tile. Comply with installation requirements of ANSI A108.11

2.7 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
 - 1. Material: Galvanized steel sheet or rolled zinc.
 - 2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
 - a. Cornerbead on outside corners, unless otherwise indicated.
 - b. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
 - c. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
 - d. One-piece expansion joint formed with V-shaped slot and removable strip covering slot opening.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.

2.8 SECURITY MESH

- A. Expanded metal security mesh; Securex “Security Mesh”. 1” mesh size, #16. Install where noted on the partition types.
- B. Provide matching “Securex” clips for installation.

2.9 JOINT TREATMENT MATERIALS

- A. General: Provide joint treatment materials complying with ASTM C 475/C 475M and the recommendations of both the manufacturers of panel products and of joint treatment materials for each application indicated.
- B. Joint Tape for Gypsum Board: Pressure-sensitive or staple-attached, open-weave, glass-fiber reinforcing tape with setting-type joint compound.
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Board: 10-by-10 glass mesh or as recommended by board manufacturer.
- C. Setting-Type Joint Compounds for Interior Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
 - 1. Ready-Mixed Formulation: Factory-mixed product.
 - a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
 - b. Topping compound formulated for fill (second) and finish (third) coats.
 - c. All-purpose compound formulated for both taping and topping compounds.

2.10 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials for gypsum board assemblies that comply with referenced standards and recommendations of gypsum board and framing manufacturers.
- B. Isolation Strip at Exterior Walls: Provide the following:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.
- C. 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."
- D. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
- E. Steel Drill Screws: Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- F. Spot Grout: ASTM C475, setting-type joint compound recommended for spot grouting hollow metal door frames.
- G. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- H. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90. Product has flame-spread and smoke-developed indexes of less than 25 per ASTM E84.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Acoustical Sealant for Exposed and Concealed Joints:
 - 1) Momentive Performance Materials; RCS 20.
 - 2) Pecora Corporation; AC-20 FTR.
 - 3) USG Corporation; SHEETROCK Brand Acoustical Sealant.
 - 2. Environmental Performance:
 - a. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- I. Partition End Closures: Continuous closed cell neoprene compressible filler complying with ASTM D1056; with pressure sensitive temporary positioning adhesive on both sides; thickness and width as shown, or as required to provide a complete sound seal at curtain wall mullions and glass curtain walls.
- J. Electrical Box Pads: Polybutene pads, 1/8 inch (3 mm) thick, Lowery's Electrical Box Pads as manufactured by Harry A. Lowery & Associates, Inc., Sun Valley, CA 91352, or other approved by Architect.
- K. Fire Rated Electrical Box Pads: Putty Pads; moldable non-curing one component, intumescent, fire-rated material for through-penetration fire stop systems and sound attenuation systems; self-adhering; 1/8 inch (3 mm) thick minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, including installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.
 - 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 (610 mm) 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.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing system components to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
- 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. Where galvanized studs are cut, provide touch-up galvanizing at cut surfaces.
- 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 that penetrate partitions above ceiling.
 1. Fasteners: Secure runners to substrates with fasteners spaced a maximum of 24 inches (600 mm) on center unless closer spacing is recommended by the framing manufacturer for the floor and ceiling construction involved. Provide fasteners at all corners and ends of runner tracks.
 2. 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.

- E. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.
- F. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 - 1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
 - 2. For fire-resistance-rated and STC-rated assemblies that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
 - a. Terminate partition framing at suspended ceilings where indicated.
- G. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, and as follows:
 - 1. Single Doors to 32 inches (813 mm) Wide: Two 0.027 inch (0.69 mm) thick studs or one 0.045 inch (1.14 mm) thick stud at each jamb and one additional stud no more than 6 inches (150 mm) from stud. At fire rated openings, use one 0.045 inch (1.14 mm) thick stud only.
 - 2. At all welded frames with fixed anchor clips secure stud reinforcing to jamb anchor clips with not less than two self-tapping screws per clip.
 - 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- H. 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.
 - 1. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- I. Z-Furring Members:
 - 1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches (610 mm) 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 (610 mm) 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 (305 mm) from corner and cut insulation to fit.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING SECURITY MESH

- A. Apply mesh panels and fasten to studs using clips and butting panels next to each other in affected areas.

3.6 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840, GA 214 and GA-216.
- B. Tolerances: Light gage framing within 1/8 inch in 10 ft. (3mm in 3048mm) (non-cumulative) for plumbness and level, +/- 1/8 in (3 mm). for fastening surfaces of adjacent framing members and for deviation from specified spacing.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- E. 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. Avoid joints other than control joints at corners of framed openings where possible.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Form control and expansion joints with space between edges of adjoining gypsum panels.
- I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4 to 3/8 inch (6.4 to 9.5 mm) wide joints to install sealant.
- J. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4 to 1/2 inch (6.4 to 12.7-mm) wide spaces at these locations and

trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- K. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion 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 manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
 - 1. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
- L. Cut openings in gypsum board for electrical outlets, piping and other penetrations. Maintain close tolerances so that edges will be covered by plates and escutcheons. Cut both face and back paper. Do not install electrical outlets back to back on opposing sides of partitions
- M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.
 - 1. Space screws a maximum of 12 inches (300 mm) o.c. for vertical applications.
 - 2. Install fasteners not less than 3/8-inch (9 mm) from ends or edges of wallboard sheets, spacing fasteners opposite each other on adjacent ends or edges.
 - 3. Space fasteners in panels that are tile substrates a maximum of 8 inches (200 mm) o.c.

3.7 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. At hollow metal door frames, cut gypsum boards to fit around hardware reinforcement or mortar boxes. Spot grout frames with a quick setting grout or compound at each jamb anchor clip just prior to inserting of boards into frame at tenant entry doors and base building doors. Insert boards into frame so that its edge is fully bedded against inside surface of the frame. Butter the edge of boards with joint compound if necessary to achieve full bedding.

3.8 LARGE FORMAT TILE BACKING PANEL INSTALLATION

- A. General: large format tile is any tile with one dimension larger than 15 inches per the TCNA. See 090000 for location and size of tiles.
- B. Install backing boards substrates in accordance with requirements of the Tile Council of North America TCNA and tile manufacturer's recommendations and written instructions
- C. Maximum substrate variation not to exceed 1/8 inch in 10 ft. (3mm in 3048mm) when measured from surface high points with a straight-edge. Do not allow lippage between adjacent panels.
- D. Install horizontal reinforcing framing 48 inches (1219mm) o.c. for full height of partitions to stiffen wall and limit wall deflection to L/480 of the overall height of wall, not to exceed 1/2 inch (12mm), except for hand set dimension stone panel walls which shall be stiffened to L/720 not to exceed 1/4 inch (6mm).

3.9 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install cornerbead at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
 - 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 - 2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
 - 3. Install U-bead where indicated.
- D. Install control joints according to ASTM C 840 and GA 216 and in specific locations approved by Architect for visual effect; except, that in no case shall control joints in ceilings, soffits, or partitions be spaced at distances greater than 30-linear feet (9 m).
 - 1. Control joints shall be installed where partitions, walls, or ceilings traverse a construction joint (expansion, seismic, or building control element) in the base building structure.
 - 2. Control joints shall be installed where a wall or partition runs in an uninterrupted straight plan exceeding 30-linear feet (9.1 m).
 - 3. Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 feet (15 m) and total area between control joints does not exceed 2,500-sq. ft.(230 sq. m)
 - 4. A control joint shall be installed where partition, wall, or ceiling backup construction or framing changes within plane of partition, wall, or ceiling.
 - 5. Control joints shall be installed where wings of "L", "U", and "T" –shaped ceiling areas are joined together.

- E. Install edge trim where edge of gypsum panels would otherwise be exposed or semiexposed. Provide edge trim type with face flange formed to receive joint compound.
- F. Install aluminum accessories where indicated.

3.10 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.
- D. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.
- E. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C840 and GA 214, for locations indicated:
 - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies. For use at panels at ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for ceramic or acoustical tile. Level 2 finish shall be applied where panels are substrate for tile, and other locations where indicated. Provide level 2 finishes in unexposed areas such as insides of closets, and electrical equipment rooms.
 - 3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges. Joint compound shall be smooth and free from tool marks and ridges. Level 3 finish shall be applied to panels in Mechanical Rooms, Electrical Rooms, and similar spaces. .
 - 4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges. Joint compound shall be smooth and free from tool marks and ridges. Level 4 finish shall be applied to panels in all locations except where another level of finish is specified, and at panel surfaces that will be exposed to view, unless otherwise indicated.
 - 1. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply min. 1/16 in (1.6mm). skim coat of joint compound over entire surface where indicated for a Level "5" finish in accordance with "Recommended Specification Levels of Gypsum Board Finish" as developed by AWCI, Cisca, Gypsum Association and PDCA. Provide level 5 finish at all exposed interior walls, soffits, ceilings in the public and SLFDA offices and for all walls used as substrate for decorative finishes. Level 5 is the typical panel finish in all public use areas and public-facing areas. Finish closets that are part of a room to match the wall finish in the room.

2. Provide level 5 finish at all exposed drywall surfaces including soffits within:
 - a. Partitions with continuous, unbroken length of 20 feet (6 m).
 - b. Horizontal and vertical surfaces of soffits.
- F. Finish Tolerances
 1. Finish board surfaces within 1/4 inch (6.4 mm) in 10 feet (3 m) (non-cumulative) for plumb, level, warp and bow.
 2. Finish board surfaces within plus or minus 1/4 inch (6.4 mm) from plan location.
 3. Finish board surfaces within 1/16 inch (1.5 mm) between planes of board faces.
- G. Tile Backing Panels: Finish according to manufacturer's written instructions.

3.11 cmar'S FIELD QUALITY CONTROL

- A. Testing for STC Ratings: Conduct Sound Transmission Class field ratings tests in accordance with ASTM E336 for partitions in sound controlled spaces where indicated. The Owner may designate similar sized spaces, in lieu of those indicated, for conducting tests.

3.12 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.13 SOUND CONTROL REQUIREMENTS

<i>Room Function #:</i>	<i>Room Number:</i>	<i>Name:</i>	<i>STC Requirement</i>	<i>Comment</i>
113.01.0003	CAS-2-003	OUTBOUND OFFICE	50-55	
113.01.0004	CAS-2-004	OUTBOUND SEARCH ROOM	50-55	
113.01.0007	CAW-2-025	OUTBOUND SEARCH ROOM	50-55	
113.01.0012	CAW-2-030	OUTBOUND SEARCH ROOM	50-55	
113.02.02.0004	TCBP-1- 023.1050.3	CTR HOLD ROOM	45	

113.03.01.0008	TCBP-1- 023.2050.1	CTR SEARCH ROOM	50-55	
113.03.01.0009	TCBP-1- 023.3050.2	CTR INTERVIEW ROOM	50-55	
113.03.01.0010	TCBP-1- 026039.A	INTERVIEW	50-55	
113.03.02.0002	TCBP-1- 027033.1	CANINE KENNEL	55	
113.03.01.0011	TCBP-1-034	REFERRAL PASS WAITING	50-55	
113.03.01.0014	TCBP-1-037	SOFT INTERVIEW	50-55	
113.03.01.0015	TCBP-1-038	SEARCH ROOM	50-55	
113.03.01.0016	TCBP-1-039	INTERVIEW	50-55	
113.03.01.0019	TCBP-1-040.3	VOLUNTARY HOLD RM	45	
113.03.01.0020	TCBP-1-040.4	HOLD RM	45	
113.03.01.0021	TCBP-1-040.6	HOLD RM	45	
113.03.01.0022	TCBP-1-041A	TRIAGE/FRAUD DOCUMENTS	45	Open to circulation
113.03.02.0006	TCBP-1-042A	ENFORCE/TOOL ROOM	50-55	
113.03.02.0008	TCBP-1-045	SECONDARY SUPERVISOR OFFICE	45	
113.03.01.0026	TCBP-1-047	CASHIER'S OFFICE	50-55	
113.03.02.0009	TCBP-1-048	PPE STORAGE	40	
113.03.02.0010	TCBP-1-048A	BIRD HOLD ROOM	40-45	
113.03.02.0011	TCBP-1-049	AG DISPOSAL	50-55	
113.03.02.0012	TCBP-1-049A	AG LAB	50-55	
113.04.0005	TCBP-1-05 63	CBP PORT DIRECTOR	50-55	
113.04.0007	TCBP-1- 055A026	INK	50-55	
113.04.0008	TCBP-1- 056016	WEAPON CLEANING	45	
113.04.0009	TCBP-1- 057023	LAN ADMIN	45	
113.02.02.0005	TCBP-1- 060011B	CBP COMMAND CENTER	50-55	
113.04.0012	TCBP-1- 061066	PAU OFFICE	50-55	
113.04.0013	TCBP-1- 064054	CBP DIRECTOR CONFERENCE	50-55	
113.04.0014	TCBP-1- 064A055	CHIEF OFFICE	50-55	
113.04.0017	TCBP-1- 065.1061.1	INTERVIEW	50-55	
113.04.0018	TCBP-1- 065.2061.2	INTERVIEW	50-55	
113.04.0019	TCBP-1- 065.3061	GLOBAL ENTRY OFFICE	45-50	
113.04.0021	TCBP-1- 067019	MUSTER TRAINING	50-55	
113.04.0028	TCBP-1- 071A022A	LACTATION SUPPORT ROOM	50-55	
113.04.0030	TCBP-1- 073065	SUPERVISOR	55	

113.04.0031	TCBP-1- 076 067	CBP GENERAL OFFICE	50-55	
N/A	TCBP-1-068	PROGRAM MANAGER	50-55	
N/A	TCBP-1-038	SEARCH ROOM	50-55	

END OF SECTION

PROJECT SPECIFICATION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

SALT LAKE CITY INTERNATIONAL AIRPORT

3	01.07.20	FCR 00666
2	08.18.16	Bulletin 01
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Section includes locking metal panel ceiling system used in selected areas.

1.3 PREINSTALLATION MEETINGS

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

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.
 - 3. Accessories: One of each specified items.
- E. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Show any non-standard panel sizes.
 - 3. Structural members to which suspension systems will be attached.
 - 4. Method of attaching hangers to building structure.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling including the following:

- a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Fire alarms and lights
- 7. Perimeter moldings.
- 8. Minimum Drawing Scale: 1/4 inch = 1 foot (1:48).
- F. Qualification Data: For testing agency.
- G. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- H. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- I. Field quality-control reports.
- J. Maintenance Data: For finishes to include in maintenance manuals.
- K. Maintenance Materials: See Division 01 Section 017846 "Extra Stock Materials" for requirements related to this section.
- L. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials that comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

1.5 TRADE CONTRACTOR'S QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup as indicated in Division 01.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and metal suspension systems with other construction that penetrates or is supported by the ceiling systems, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL CEILINGS, GENERAL

- A. Acoustical Panel Ceiling Selections: Refer to the acoustical ceiling selections listed in the Finish Legend on the Drawings for product selection, sizes, finishes and suspension systems required and to the Room Finish Schedule for locations required. Low-Emitting Materials: Acoustical panel ceilings 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. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- D. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- E. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.
- F. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- G. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
- H. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

- A. Acoustical Panel Ceiling Selections: Refer to the lay-in acoustical panel ceiling selections listed in the Section 090000 Finishes Specification for locations. Each ceiling panel type and appropriate grid is shown. See the drawings for ceiling layout.
 - 1. Subject to compliance with requirements, provide product indicated on the Schedule on the drawings or comparable product by one of the following:
 - a. Armstrong World Industries, Inc. (basis of design)
 - b. Rockfon (formerly Chicago Metallic Corporation.)
 - c. USG Interiors, Inc.; Subsidiary of USG Corporation.

2. TechZone Ceiling: See ceiling layouts for utilities above ceiling organized into zones. Provide bridging clips, stacking clips and other connections as needed.
 3. Recycled content: provide panels with minimum 25% recycled content.
 4. Edges: provide panels with all edges finished and profiled. Provide factory finished edges for all custom and/or non-standard ceiling panel sizes.
- B. Metal Ceiling Panels:
1. Provide a complete, integrated assembly, including security ceiling panels, exposed suspension system, perimeter supports, and accessories.
 - a. Basis of design: Armstrong World Industries “METALWORKS” panel and grid #6642M15 Tegular” Noted as MPC52 and MPC53
 - b. USG Interiors Panz
 - c. Rockfon Planostile
 2. Panels: Fabricated from a single sheet of metal, with formed upturned edges on all four sides
 3. Aluminum Panels: Nominal sheet thickness of 0.040 inch (1.0 mm).
 4. Panel Size: 24 by 48 inches (610 by 1220 mm).
 5. Perforation Pattern: round, diagonal with hole size of 1.6 mm; 12% open area; 9/32” unperforated border.
 6. Grid: Suprafine XL 9/16”
 7. Noise Reduction Coefficient (NRC): 0.90.
- C. Metal Ceiling panels used at vestibules: Exterior panels with ¼” reveal.
1. Basis of Design: Armstrong MetalWorks Vector Exterior Extra Microperforated 6466M3. Noted as MPC57
 2. Also approved:
 - a. USG Celebration Snap-In metal panels, perforated
 - b. Rockfon Planostile Exterior Snap in Metal Panel System
 3. Size: 24” x 24”
 4. Finish: factory applied powder coated finish; custom color
 5. Grid: Prelude XL 15/16”
 6. Grid finish: white exterior
 7. Acoustics: NRC of 0.65
- D. Sound-Absorptive Pads: Provide sound-absorptive pads for placement over ceiling panels. Provide acoustical fleece and 1” fiberglass infill panel #8200100.
1. Spacer Grids: Aluminum grid units that provide an air cushion between security ceiling panels and sound-absorptive pads and that act to improve sound absorption.
 2. Support Clips: Metal clips designed to hold sound-absorptive pads above bottom face sheet.

2.4 DOWNWARD-LOCKING-PANEL SECURITY CEILING ASSEMBLY

- A. Provide a complete, integrated assembly, including security ceiling panels, exposed suspension system, perimeter supports, and accessories.
1. Basis of design: Armstrong World Industries “METALWORKS SecureLock Perforated” 5488P4WH Noted as MPC55
 2. Also approved: Rockfon Metaline Lock-in Metal Panel System

- B. Panels: Fabricated from a single sheet of metal, with formed upturned edges on all four sides designed to continuously engage with and lock under rectangular bulb of suspension system.
 - 1. Aluminum Panels: Nominal sheet thickness of 0.040 inch (1.0 mm).
 - 2. Panel Size: 24 by 24 inches (610 by 610 mm).
 - 3. Perforation Pattern: round, diagonal with hole size of 1.6 mm; 12% open area;
 - 4. Noise Reduction Coefficient (NRC): 0.80.
 - 5. Color: factory applied powder coat, applied after forming, white
- C. Grid: Prelude XL items 7301-12; HD main beam XL8320 and 2' cross tees.
- D. Sound-Absorptive Pads: Provide sound-absorptive pads for placement over ceiling panels. Provide acoustical fleece and 1" fiberglass infill panel #8200100.
 - 1. Spacer Grids: Aluminum grid units that provide an air cushion between security ceiling panels and sound-absorptive pads and that act to improve sound absorption.
 - 2. Support Clips: Metal clips designed to hold sound-absorptive pads above bottom face sheet.
- E. Access Panels: Material, perforation pattern, and finish same as security ceiling panels; designed for installation by security fasteners screwed through suspension system. Provide panels at locations indicated on Drawings.
 - 1. Size: standard panel size; located as indicated on Drawings.
 - 2. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."
- F. Suspension System: ASTM C 635/C 635M, heavy-duty exposed system consisting of snap-in main runners supported by hangers attached to building structure.
 - 1. Provide system complete with main runners, splice plates, connector and alignment clips, hangers, trim, seismic- and wind-load clips and struts, and other suspension components required to support security ceiling units and other security ceiling-supported construction.
 - 2. Main Runners and Cross Tees: Aluminum, Armstrong Suprafine XL exposed Tee.
 - 3. Wire Hangers, Braces, and Ties: Zinc-coated, carbon-steel wire, ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - a. Size: Select wire diameter so its stress at 3 times the hanger design load (ASTM C 635/C 635M, 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.
 - 4. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
 - 5. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
 - 6. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide, formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet, G90 (Z275) zinc coating, with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
 - 7. Compression Struts: Fabricated from 3/4-inch- (19-mm-) diameter steel tubing, designed to fit over rectangular bulb of suspension system.
 - 8. Security Clips: Steel wire, designed to slip over suspension system and through holes in flanges of panel to prevent panel removal.
- G. Perimeter Supports: Wall-mounted channel moldings and wall angles; fabricated from 0.040-inch- (1.0-mm-) thick aluminum; finished to match suspension system.

- H. Exposed Edge Moldings and Trim: Provide exposed members as indicated or required for edges of security ceiling, fixture trim, beams, fasciae at changes in security ceiling height, and other conditions; of metal and finish matching security ceiling panels.
- I. Materials:
 - 1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M). Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength.
 - 2. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M).

2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung – Heavy Duty," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, 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 according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled expansion anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - 3. Size: Select wire diameter so its stress at three times hanger design load will be less than yield stress of wire. Meet requirements of ASCE-7 for loading requirements.
- E. Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
 - 1. Flat Hangers: Steel sheet, 1 by 1/8 inch (25 by 3 mm by length indicated).
 - 2. Rod Hangers: ASTM A 510/A 510M, mild carbon steel rods, 1/4 inch (6 mm) in diameter.

- F. Carrying Channels: ASTM C754, cold-rolled, commercial-steel sheet with a base-metal thickness of 0.054 inch (1.37 mm) and minimum 1/2-inch (13-mm) wide flanges.
 - 1. Corrosion Protection: Zinc coated.
 - 2. Weight: 457 lb. /1000 ft. (0.707 kg/m) minimum.
 - 3. Depth: 1-1/2 inches (38 mm) or as otherwise indicated on Drawings
- G. Direct Hang Clip: Manufacturer's standard clip for attaching main runner to carrying channels.
- H. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- I. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- J. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- K. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

2.6 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - 1. Armstrong World Industries, Inc.
 - 2. Rockfon
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Selections: see 090000 for selected systems for each ceiling panel.

2.7 METAL EDGE MOLDINGS AND TRIM

- A. Provide metal edge moldings and trim by the same manufacturer as the suspension systems, and compatible with the system.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - 1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.

- a. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, provide one of the following :
 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
 2. Acoustical Sealant for Concealed Joints:
 - a. Pecora Corporation; AIS-919.
 - b. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
 3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. 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, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel 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."
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Install carrying channels so that they are level with 1/8 inch (3 mm) in 12 feet (3.6 m). Attach channels to hangers to resist vertical or twisting movement.
 - 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 8. 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.
 - 9. Do not attach hangers to steel deck tabs.
 - 10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 11. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - 12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. 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.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members or members with damaged finish.
- 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.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
 - 5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 OWNER'S QUALITY CONTROL

- A. Special Inspections: CMAR will engage a qualified special inspector to perform the following special inspections:
 - 1. Compliance of seismic design.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
 - 1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

PROJECT SPECIFICATION

SECTION 09 91 26

INTERIOR PAINTING

SALT LAKE CITY INTERNATIONAL AIRPORT

<u>4</u>	<u>01.07.20</u>	<u>FCR 00666</u>
3	08.31.17	Bulletin 08
2	03.17.17	Bulletin 04
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 09 91 26 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
 - 1. Concrete.
 - 2. Concrete masonry units (CMUs).
 - 3. Galvanized metal.
 - 4. Gypsum board.
 - 5. Gypsum columns
- B. Related Requirements:
 - 1. Division 05 Sections for shop priming of metal stairs, metal fabrications and metal handrails.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 2. Indicate VOC content.
- B. LEED Submittals:
1. Product Data for Credit EQ 4.2: For paints and coatings, documentation including printed statement of VOC content showing compliance.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
- E.F. See Section 017846 "Extra Stock Materials" for additional information.
- ~~F. —Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.~~
- ~~1. —Paint: —10 gallons of each material and color applied.~~

1.5 TRADE CONTRACTOR'S 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.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 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.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Benjamin Moore & Co.
 2. Glidden Professional.
 3. PPG Architectural Finishes, Inc.
 4. Sherwin-Williams Company /Kwal Paint.
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content:
1. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
 2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L (2lb/gal) established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
 3. Low-Emitting Materials: Adhesives, Sealants and Sealant Primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168. Volatile organic compound (VOC) limits listed in the table below correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.
- D. Colors: As indicated in 090000.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
- B. CMAR will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
1. Testing agency will perform tests for compliance with product requirements.
- C. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Masonry (CMUs): 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Gypsum Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete 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.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer. but not less than the following:
 - 1. SSPC-SP 7/NACE No. 4.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
- B. 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.
- C. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- D. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- E. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- F. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- G. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- H. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- I. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear that are not factory painted.
 - b. Tanks that do not have factory-applied final finishes.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards, that are not factory painted.
 - b. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: CMAR may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. High-Performance Architectural Latex System MPI INT 3.1C:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat. MPI #138
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.
- B. Concrete Substrates, Traffic Surfaces:
 - 1. Latex Floor Enamel System MPI INT 3.2A G2/3:
 - a. Prime Coat: Floor paint, latex, matching topcoat. MPI #60
 - b. Intermediate Coat: Floor paint, latex, matching topcoat. MPI #60
 - c. Topcoat: Floor paint, latex, low gloss (maximum MPI Gloss Level 3), MPI #60.
- C. CMU Substrates:

1. Water-Based Light Industrial Coating System MPI INT 4.2K:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Light industrial coating, interior, water based, and matching topcoat. MPI#151
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.
- D. Steel Substrates: interior metal to be painted, not scheduled for high performance coating
 1. Water-Based Light Industrial Coating System MPI INT 5.1B:
 - a. Prime Coat: Primer, rust-inhibitive, water based MPI #107.
 - b. Intermediate Coat: Light industrial coating, interior, water based, and matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.
- E. Galvanized-Metal Substrates: interior metal to be painted not scheduled for high performance coating
 1. Latex System MPI INT 5.3K G5:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, matching topcoat. MPI #153
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #153.
- F. Cement Board Substrates: (limited areas; see elevations)
 1. Latex System MPI INT 3.3A:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior (MPI Gloss Level 2), MPI #44.
- G. Gypsum Board Substrates and Gypsum Plaster substrates: (typical interior walls)
 1. High-Performance Architectural Latex System MPI INT 9.2B: G2
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat. MPI # 138
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.
 - e. Use anti-mildew additive in wet areas, and unconditioned spaces.

END OF SECTION 099126

PROJECT SPECIFICATION

SECTION 21 05 15

SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 21 05 15 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes sleeves for piping through concrete slabs, walls, floors as follows:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Proco Products, Inc.
 - 5. Innerlynx.
 - 6. Link-Seal.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Basis-of-Design Product: Presealed Systems
- B. Description: Manufactured plastic, sleeve-type, water-stop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber water-stop collar with center opening to match piping OD.

2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for all piping passing through penetrations in floors, partitions, roofs, and walls.

- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
 - 4. Sleeves must extend 2" above floor level.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire-stop materials. Comply with requirements for fire-stopping specified in Section 078413 "Penetration Fire-stopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water-stop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller than NPS 6 (inches): Cast-iron pipe sleeves.
 - b. Piping NPS 6 (inches) and Larger: Cast-iron pipe sleeves.
 - 2. Concrete Slabs-on-Grade:
 - a. Piping Smaller than NPS 6 (inches): Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs above Grade:
 - a. Piping Smaller than NPS 6 (inches): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (inches).
 - 4. Interior Partitions:
 - a. Piping Smaller than NPS 6 (inches): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (inches) and Larger: Galvanized-steel-sheet sleeves.

3.5 GROUTING

- A. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout to completely fill equipment bases.
- F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION 21 05 15

PROJECT SPECIFICATION

SECTION 21 05 20

ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

SALT LAKE CITY INTERNATIONAL AIRPORT

<u>2</u>	01.07.20	<u>FCR 0666</u>
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 21 05 20 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes escutcheons for all exposed horizontal piping penetrating walls in finished spaces and where piping is exposed to view.
- B. All piping entering and leaving finished areas shall be installed in parallel configuration for efficient installation.
- C. Related Sections:
 - 1. Section 21 12 05, "Fire Suppression Standpipes."
 - 2. Section 21 13 15, "Wet Pipe Sprinkler Systems."
 - 3. Section 21 13 20, "Dry-Pipe Sprinkler Systems."
 - 4. Section 22 13 35, "Double Interlock Preaction System."

1.3 SUBMITTALS

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

1.4 EXTRA MATERIALS

- A. Refer to Division 01 Section 017846 for Maintenance Material Stock.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

- C. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide escutcheons for piping penetrations of walls in finished spaces where piping is exposed to view and as follows:
 - 1. Enclosed areas but open to ambient temperatures.
 - 2. Delta Outbound Baggage
 - 3. Common Out Bound Baggage
 - 4. Ski Ops
 - 5. Domestic Baggage Off-Load
 - 6. Baggage Processing.
 - 7. Stairwells
 - 8. Exterior wall penetrations
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Bare Piping at Wall Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- C. All piping entering and exiting finished areas shall be installed in a parallel configuration for efficient installation. Minimum distance between escutcheons plates shall be 2-inches.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.
- B. Contractor shall walk project site with OAR prior to Certificate of Occupancy to review sign-off that all pipe penetrations in finished areas have been provided with escutcheons.

3.3 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 20

PROJECT SPECIFICATION

SECTION 21 05 25

GENERAL-DUTY VALVES FOR FIRE PROTECTION

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 21 05 25 - GENERAL-DUTY VALVES FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes:
 - 1. Two-piece ball valves with indicators.
 - 2. Bronze butterfly valves with indicators.
 - 3. Iron butterfly valves with indicators.
 - 4. Check valves.
 - 5. Bronze OS&Y gate valves.
 - 6. Iron OS&Y gate valves.
 - 7. Trim and drain valves.

1.3 DEFINITIONS

- A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. SBR: Styrene-butadiene rubber.

1.4 SUBMITTALS

- A. Action Submittals
 - 1. Product Data: For each type of valve.
 - a. Indicate UL and FM compliance where specified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.

3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
 1. Fire Main Equipment.
 - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
 - b. Level 1: HLOT - Valves.
 - 1) Ball Valves, System Control.
 - 2) Butterfly Valves.
 - 3) Check Valves.
 - 4) Gate Valves.
 2. Automated Sprinkler System & Water Spray System Devices.
 - a. Valves, Trim and Drain.
- B. Source Limitations for Valves for each building: Obtain valves for each valve type from single manufacturer.
- C. ASME Compliance:
 1. ASME B16.1 for flanges on iron valves.
 2. ASME B1.20.1 for threads for threaded-end valves.
 3. ASME B31.9 for building services piping valves.
- D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- E. NFPA Compliance.
- F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Actuator Types:
 - 1. Handlever: For quarter-turn trim and drain valves NPS 3 and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. NIBCO INC.
- B. Description:
 - 1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body Design: Two piece.
 - 4. Body Material: Forged brass or bronze.
 - 5. Port Size: Full or standard.
 - 6. Seats: PTFE.
 - 7. Stem: Bronze or stainless steel.
 - 8. Ball: Chrome-plated brass.
 - 9. Actuator: Worm gear.
 - 10. Supervisory Switch: Internal or external.
 - 11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
 - 12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fivalco Inc.
 - 2. Globe Fire Sprinkler Corporation.
- B. Description:
 - 1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
 - 2. Minimum: Pressure rating: 175 psig.
 - 3. Body Material: Bronze.
 - 4. Seat Material: EPDM.
 - 5. Stem Material: Bronze or stainless steel.
 - 6. Disc: Bronze with EPDM coating.
 - 7. Actuator: Worm gear or traveling nut.
 - 8. Supervisory Switch: Internal or external.
 - 9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.

10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Anvil International, Inc.
 2. Fivalco Inc.
 3. Globe Fire Sprinkler Corporation.
 4. Kennedy Valve; a division of McWane, Inc.
 5. NIBCO INC.
 6. Tyco Fire & Building Products LP.
- B. Description:
 1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
 2. Minimum Pressure Rating: 175 psig.
 3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
 4. Seat Material: EPDM.
 5. Stem: Stainless steel.
 6. Disc: Ductile iron, nickel plated.
 7. Actuator: Worm gear or traveling nut.
 8. Supervisory Switch: Internal or external.
 9. Body Design: Grooved-end connections.

2.5 CHECK VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Anvil International, Inc.
 2. Fire Protection Products, Inc.
 3. Fivalco Inc.
 4. Globe Fire Sprinkler Corporation.
 5. Kennedy Valve; a division of McWane, Inc.
 6. Matco-Norca.
 7. Mueller Co.; Water Products Division.
 8. NIBCO INC.
 9. Reliable Automatic Sprinkler Co., Inc.
 10. Shurjoint Piping Products.
 11. Tyco Fire & Building Products LP.
 12. United Brass Works, Inc.
 13. Venus Fire Protection Ltd.
 14. Viking Corporation.
 15. Watts Water Technologies, Inc.
 16. Wilson & Cousins Inc.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NIBCO INC.
2. United Brass Works, Inc.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

Manufacturers:

1. American Cast Iron Pipe Company; Waterous Company subsidiary.
2. Clow Valve Company; a division of McWane, Inc.
3. Hammond Valve.
4. Kennedy Valve; a division of McWane, Inc.
5. NIBCO INC.
6. Victaulic Company.
7. Watts Water Technologies, Inc.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).

2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Grooved or flanged

2.8 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. Fire-End & Croker Corporation.
- c. Fire Protection Products, Inc.
- d. Flowserve.
- e. FNW; Ferguson Enterprises, Inc.
- f. Jomar International, LTD.
- g. Kitz Corporation.
- h. Legend Valve.
- i. Metso Automation USA Inc.
- j. Milwaukee Valve Company.
- k. NIBCO INC.
- l. Potter Roemer.
- m. Red-White Valve Corporation.
- n. Tyco Fire & Building Products LP.
- o. Victaulic Company.
- p. Watts Water Technologies, Inc.

2. Description:

- a. Pressure Rating: 175 psig.
- b. Body Design: Two piece.
- c. Body Material: Forged brass or bronze.
- d. Port size: Full or standard.
- e. Seats: PTFE.
- f. Stem: Bronze or stainless steel.
- g. Ball: Chrome-plated brass.
- h. Actuator: Handlever.
- i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
- j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2 : Grooved ends.

B. Angle Valves:

1. Manufacturers:

- a. NIBCO, Inc.
 - b. Fire Protection Products, Inc.
 - c. United Brass Works, Inc.
 - 2. Description:
 - a. Minimum Pressure Rating: 175 psig.
 - b. Body Material: Brass or bronze.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.
- C. Globe Valves:
- 1. Manufacturers:
 - a. Nibco, Inc.
 - b. United Brass Works, Inc.
 - 2. Description:
 - a. Pressure Rating: 175 psig.
 - b. Body Material: Bronze with integral seat and screw-in bonnet.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc Holder and Nut: Bronze.
 - f. Disc Seat: Nitrile.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

- E. Do not attempt to repair defective valves; replace with new valves.

3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

- A. Comply with requirements of all Division 21 Sections as they all apply.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 210550 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed.
- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
- I. Install secondary shut-off valve downstream of trip valve assembly at all fire riser assembly locations for ease of commissioning and annual testing of systems.

END OF SECTION 21 05 25

PROJECT SPECIFICATION

SECTION 26 05 20

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

SALT LAKE CITY INTERNATIONAL AIRPORT

2	03.17.17	Bulletin 04
1	05.13.16	Issue For Construction
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SECTION 26 05 20 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. VFC: Variable frequency controller.

1.4 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: For each type of product.
- B. Informational Submittals:
 - 1. Qualification Data: For testing agency.
 - 2. Field quality-control reports.

1.5 TRADE CONTRACTOR'S QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.

2. Belden Inc.
 3. Cerro Wire LLC.
 4. Encore Wire Corporation.
 5. General Cable; General Cable Corporation.
 6. Senator Wire & Cable Company.
 7. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70 / ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70 / ICEA S-95-658 for Type THHN/THWN-2 and Type XHHW-2.
- D. Multi-conductor Cable: Comply with NEMA WC 70 / ICEA S-95-658 for metal-clad cable, Type MC and Type SO with ground wire.
- E. VFC Cable:
1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
 2. Comply with UL requirements for cables in Classes I and II, Division 2 hazardous location applications.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
 2. AFC Cable Systems, Inc.
 3. Gardner Bender.
 4. Hubbell Power Systems, Inc.
 5. Ideal Industries, Inc.
 6. ILSCO.
 7. NSi Industries LLC.
 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
 9. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Provide conductors in sizes shown on the plans and as specified below.
- B. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTI-CONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Provide insulation type as specified below, color-coded as specified in Section 260554 "Identification for Electrical Systems."
- B. Service Entrance: Type XHHW-2. All shall be single conductors in raceway.
- C. Exposed Feeders: Type THHN/THWN-2 for No. 1 AWG and smaller; Type XHHW-2 for No. 1/0 AWG and larger. All shall be single conductors in raceway.
- D. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2 for No. 1 AWG and smaller; Type XHHW-2 for No. 1/0 AWG and larger. All shall be single conductors in raceway.
- E. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2. All shall be single conductors in raceway.
- F. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway for No. 1 AWG and smaller; Type XHHW-2, single conductors for No. 1/0 AWG and larger; Armored cable, Type AC; Metal-clad cable, Type MC.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2 for No. 1 AWG and smaller; Type XHHW-2 for No. 1/0 AWG and larger. All shall be single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2 for No. 1 AWG and smaller; Type XHHW-2 for No. 1/0 AWG and larger. All shall be single conductors in raceway.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2. All shall be single conductors in raceway.
- J. Branch Circuits in Cable Tray: Type THHN/THWN-2, single conductors in raceway for No. 1 AWG and smaller; Type XHHW-2, single conductors for No. 1/0 AWG and larger; Multi-conductor, PVC-sheathed Tray Cable, Type TC; Armored cable, Type AC Metal-clad cable, Type MC.

- K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- L. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 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 260534 "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 Section 260530 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material 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 (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260554 "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.

3.6 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 260545 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply fire-stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Fire-stopping."

3.8 TRADE CONTRACTOR'S QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - ~~a. — Follow up Infrared Scanning: Perform an additional follow up infrared scan of each splice 11 months after date of Substantial Completion.~~
 - ~~b.~~a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - ~~e.~~b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Cables will be considered defective if they do not pass tests and inspections. All defective cables shall be replaced at the Contractor's expense.

3.9 OWNER'S QUALITY ASSURANCE

- A. Owner's independent commissioning and witnessing agency will provide the following witnessing and/or review services:
1. Witness all infrared scanning.
 2. Review all test and inspection reports.

END OF SECTION 26 05 20

PROJECT SPECIFICATION

SECTION 21 05 50

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

SALT LAKE CITY INTERNATIONAL AIRPORT

2	11.22.17	Bulletin 11
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 21 05 50 - IDENTIFICATION FOR FIRE PROTECTION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes identification of all below and above ground fire protection piping and all equipment and valves installed under Division 21. All piping concealed or exposed shall have identification markers. All equipment and valves shall have identification markers.
- B. This section includes the following:
 - 1. Pipe markers.
 - 2. Valve tags.
 - 3. Equipment name plates.
 - 4. Underground marking tape (outside the building).
 - 5. Valve and Equipment Charts and Diagram Frames.
 - 6. Safety signs.
 - 7. Ceiling tanks.
 - 8. Locks and devices.
 - 9. Warning signs and labels.
 - 10. Warning tape.
 - 11. Warning tags.
 - 12. Settlement joint markers.
- C. Related Sections:
 - 1. Section 21 12 05, "Fire Suppression Standpipes."
 - 2. Section 21 13 15, "Wet Pipe Sprinkler Systems."
 - 3. Section 21 13 20, "Dry-Pipe Sprinkler Systems."
 - 4. Section 21 13 35, "Double Interlock Preaction System."
 - 5. Section 21 31 25, "Electric-Drive Centrifugal Fire Pump."

1.2 REFERENCES

- B. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
- C. NFPA – Applicable NFPA Standards based on system type (i.e., NFPA 13 for Automatic Sprinklers, NFPA 14 for Standpipes)

1.3 SUBMITTALS

- A. Fire Protection contractor shall verify with the Owner's Authorized Representative scheme for the identification of the fire protection piping system, and the color of painting the exposed fire protection piping Submittals.
 - 1. Product Data: Indicate model, type, and application usage.
 - 2. Submit list of wording, symbols, letter size, letter style, and color coding for the fire protection system and fire water service.
 - 3. Submit valve numbering scheme, valve chart and schedule, including valve tag number, location, function type, and valve manufacturer's name and model number.

4. Submit color swatch of red paint.

1.4 COORDINATION

- B. Coordinate with Owner's Representative for preferred color schemes and service abbreviations and valve and equipment numbering schemes prior to submittal review.
- C. Coordinate installation of identifying devices with completion of covering of surfaces where devices are to be applied.
- D. Coordinate installation of identifying devices with location of access panels and doors.
- E. Coordinate paint color schemes of fire protection piping with Owner's Representative.
- F. Install identifying devices before installing acoustical ceilings and similar concealment. If not installed before ceiling is installed, this Contractor shall remove ceiling at no additional cost to the Owner and install identifying devices.
- G. Fire Protection contractor shall verify with the Owner's Authorized Representative scheme for the identification of the fire protection piping system, and the color of painting the exposed fire protection piping

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 1. Seton Name Plate Corp.
 2. Brimar.
 3. Brady.

2.2 PIPE MARKERS

- A. Markers: ANSI A13.1-81.
 1. Pressure sensitive vinyl (self sticking) material.
 2. Mechanically fastened type: Snap on or strap on.
 - a. For dirty, greasy, or oily pipe where pressure sensitive markers may not perform satisfactorily.
 3. All weather film for outdoor exposed piping.
 4. Provide 360 degree and pipe flow arrows and fluid being conveyed.
 5. Size of letters legend:

<u>OUTSIDE DIAMETER OF PIPE OR PIPE COVERING</u>	<u>LENGTH OF COLOR FIELD</u>	<u>SIZE OF LETTERS AND ARROWS</u>
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
8 to 10 inches	24 inch	2-1/2 inch

Over 10 inches

32 inch

3-1/2 inch

2.3 PAINTING

- A. As a minimum, paint all exposed fire water service and sprinkler piping red as follows:
 - 1. All exposed piping in the Mechanical and Plumbing Rooms.
 - 2. All exposed piping in the Fire Protection Rooms.
- B. Coordinate with the Owner's Authorized Representative all exposed piping to be painted prior to start of any Work.

2.4 VALVE TAGS

- A. Tags: Brass or anodized aluminum type.
 - 1. Brass: Minimum 19 gage, polished, 2 INCH diameter with following lettering:
 - a. Service: 1/4 inch stamped black filled letters.
 - b. Valve numbers: 3/8 inch stamped black filled letters.
 - 2. Aluminum: 2 inch diameter, 0.032 INCH thick, with following lettering:
 - a. Service: 1/4 inch engraved letters.
 - b. Valve numbers: 3/8 inch engraved letters.
- B. Fasteners: 4 ply 0.018 copper or monel wire meter seals, brass "S" hooks or No. 16 brass jack chain.

2.5 EQUIPMENT NAME PLATES

- A. 1/8 inch rigid plastic or bakelite with 4 edges beveled, with black background and white border and letters.
 - 1. Two 3/8 inch mounting holes.
 - 2. Minimum 1/2 inch high lettering.
 - 3. Commercial quality, rust resisting nuts and bolts with backwashers, self tapping screws or rivets.

2.6 UNDERGROUND MARKING TAPE (OUTSIDE THE BUILDING)

- A. General: Provide underground pipe marking tape on all pipes buried beneath the ground. Provide a continuous length of tape 12-inches below the finished earth surface directly above the buried pipe. Provide a second continuous length of tape 12-inches above the top of the buried pipe if the top of the pipe is lower than 36-inches from the top of the finished earth surface.
- B. Tape: 5 mil inert plastic film for underground use.
- C. Resistant to alkalis, acids and other destructive agents found in soil; information in Civil Engineers Soils Report.
- D. Minimum tensile strength: 120 lb per 6 inch width.
- E. Minimum elongation: 500 percent.

- F. Provide detectable underground tape above all buried pipes on the Project. Provide a continuous printed message repeated every 16 to 36 inches warning of pipe buried below similar to (i.e. "CAUTION FIRE PROTECTION WATER SERVICE LINE BURIED BELOW").
- G. Color code:
 - 1. Blue: Fire Water Systems.
- H. Provide tape width of 16-inches for buried lines.

2.7 VALVE AND EQUIPMENT CHARTS AND DIAGRAM FRAMES

- A. Provide schedules giving numbers, service and locations, and notations of open or closed, of all tagged valves. Enclose each schedule in separate transparent plastic binders. List piping systems with symbol and color coding on pipe identification chart. List valve model numbers and symbol for service corresponding to piping symbol on valve identification chart. Provide small "key plan" identifying valves as related to column lines.
- B. Submit drafts of valve schedule for review before preparing final sets.
- C. Provide typewritten list of equipment in triplicate, indicating location, service for each piece of equipment, laminated.

2.8 SAFETY SIGNS

- A. Place safety signs on machines driven by electric motors which are controlled by fully automatic starters, in accordance with Article 3281, General Industry Safety Orders.

2.9 CEILING TACKS

- A. Manufacturers:
 - 1. Seton Identification Products / Tricor Direct / Brady Corporation.
 - 2. Brady Worldwide, Inc.
 - 3. Kolbi Pipe Marker Company.
- B. Description: Steel with ¾ inch diameter color-coded head.
- C. Color code as follows:
 - 1. Plumbing valves: Green

2.10 LOCKOUT DEVICES

- A. Lockout Hasps:
 - 1. Manufacturers:
 - a. Seton Identification Products / Tricor Direct / Brady Corporation.
 - b. Brady Worldwide, Inc.
 - c. Kolbi Pipe Marker Company.
 - 2. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Manufacturers:
 - a. Seton Name Plate Corp.
 - b. Brady Corporation
 - c. Brimar Corporation
2. Steel device preventing access to valve operator, accepting lock shackle.

2.11 WARNING SIGNS & LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having pre-drilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 180 deg. F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: ¼ inch for name of units if viewing distance is less than 24 inches, ½ inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.12 WARNING TAPE (HEAT TRACING)

- A. Continuously printed "Electrical Heat Tracing"; vinyl, at least 3 mils thick and with pressure sensitive, permanent waterproof, self-adhesive back for indoor applications and snap-on for outdoor applications.
 1. Width for markers on pipes with OD, including insulation, less than 6-inches: ¾" minimum.
 2. Width for markers on pipes with OD, including insulation, less than 6-inches and larger: 1-1/2" minimum.

2.13 WARNING TAG

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 1. Size: Approximately 4 by 7 inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER", "CAUTION", or "DO NOT OPERATE".
 4. Color: Yellow background with black lettering.

2.14 SETTLEMENT JOINT MARKERS

- A. Manufacturers:
 - 1. 3M ScotchMark Electronic Marker with Probe Package.
- B. Full range marker for domestic water, sanitary waste, grease waste and storm drain piping systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Clean all surfaces for preparation of pipe to be painted.

3.2 VALVE AND EQUIPMENT IDENTIFICATION

- A. Designate all equipment and valves by distinguishing numbers and letters on charts and/or diagrams.
 - 1. Tag and locate following equipment items:
 - a. Valves.
 - b. All items indicated on fire protection equipment schedules.
 - 2. Designation shall match that indicated.
- B. Install tags on all devices with numbers and letters corresponding to charts.
- C. Fasten tags securely to devices with tag fasteners in manner for easy reading.
- D. Attach equipment nameplates in conspicuous location, directly on item of equipment or apparatus such as starters, pumps, and control panels.
- E. For unsuitable surfaces, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.
- F. Furnish 4 charts.
 - 1. Laminate chart and secure on wall in location directed by OAR's.
 - 2. Include remaining 3 sets in "Operation and Maintenance Manuals".
 - 3. Show valve tag numbers on project as-built drawings.

3.3 PIPE IDENTIFICATION

- A. Locate pipe markers as follows:
 - 1. Next to each valve and fitting, and equipment.
 - 2. On all horizontal pipe runs every 20 ft, at least once in each room and each story traversed by piping system.
 - 3. Identify piping contents and flow direction.

- B. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

3.4 FIRE_SUPPRESSION EQUIPMENT IDENTIFICATION

- A. **General: Install engraved plastic laminate sign or plastic equipment marker on each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs incorporating names in "EQUIPMENT NAMEPLATE" column of equipment schedules.**

B.

3.4.3.5 SERVICE ABBREVIATIONS

- A. Coordinate with Owner's Representative for preferred color schemes and service abbreviations as indicated below:

FW	Fire Protection Water Service.
SP (xxx)	Sprinkler System (Zone Number)
D	Drain.
DPS	Dry-Pipe Sprinkler System
PAS	Preaction System (System Number)

3.5.3.6 INSTALLATION OF UNDERGROUND MARKING TAPE

- A. Install underground marking tape directly above all outside incoming fire water service lines.
- B. Allow 12 inches between tape and line, and install as close to grade level as feasible.

3.6.3.7 CONTROL DIAGRAMS AND INSTRUCTIONS

- A. Diagrams and instructions may be reduced in size provided they are legible.

END OF SECTION 21 05 50

PROJECT SPECIFICATION

SECTION 21 08 00

COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue for Construction
REV.	DATE	ISSUANCE

SECTION 21 08 00 – COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 21.
- B. This project will have selected building systems commissioned. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 05 General Commissioning Requirements.

1.2 RELATED WORK

- A. Section 01 33 00 Submittal Procedures
- B. Section 01 78 23 Operation and Maintenance Data
- C. Section 01 79 00 Demonstration and Training
- D. Section 01 91 05 General Commissioning Requirements
- E. Section 11 08 00 Commissioning of Equipment
- F. Section 22 08 00 Commissioning of Fire Suppression Systems
- G. Section 23 08 00 Commissioning of HVAC systems
- H. Section 25 08 00 Commissioning of Building Automation Systems (BAS)
- I. Section 26 08 00 Commissioning of Electrical Systems
- J. Section 27 08 00 Commissioning of Communication Systems
- K. Section 28 08 00 Commissioning of Electronic Safety and Security

1.3 SUMMARY

- A. This section includes requirements for commissioning Fire Suppression systems, sub-systems and equipment. This Section supplements the general requirements specified in Section 01 91 05 General Commissioning Requirements.
- B. The commissioning activities have been developed to support delivery of project performance in accordance with the Contract Documents developed with the approval of the Owner.

- C. Refer to Section 01 91 05 General Commissioning Requirements for more information regarding processes and procedures as well as roles and responsibilities for Commissioning Team members.

1.4 DEFINITIONS

- A. Refer to Division 01 specifications for definitions.

1.5 COMMISSIONED SYSTEMS

- A. Commissioning of a system or systems specified in this Division is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's Operation and Maintenance personnel, is required in cooperation with the Owner and the Commissioning Agent.
- B. The following systems will be commissioned:
 - 1. Electric Fire Pump
 - 2. Fire Jockey Pump
 - 3. Pre-action systems
 - 4. Dry pipe systems
 - 5. Wet pipe systems

1.6 SUBMITTALS

- A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the Owner prior to forwarding to the Contractor. Refer to Section 01 33 00 Submittal Procedures for further details.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Refer to Section 01 91 05 for test equipment required.

PART 3 - EXECUTION

3.1 ADDITIONAL RESPONSIBILITIES FOR FIRE SUPPRESSION CONTRACTOR

- A. The Trade Contractor(s) will demonstrate and perform hydrostatic test and flush requirements including piping pressure testing with the CxA acting as a witness to the tests sufficient to demonstrate the procedures. If the tests result in deficiencies, the contractor will be given an Issues Log listing the deficiencies discovered during testing. When the deficiencies are rectified, the contractor will notify the CxA for final re-testing. Any subsequent re-testing due to un-resolved deficiencies will be back charged to the contractor for the CxA's time and expense at the current year's labor rate for the CxA.

- B. All tools, instruments, equipment, and labor required to execute field quality testing specified in the 21 00 00 fire suppression specifications will be by the Trade Contractor(s).

3.2 PREFUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, sub-systems, and equipment installation is complete and systems are ready for Systems Functional Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the Owner and to the Commissioning Agent for review. The Commissioning Agent may spot-check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and re-submission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and re-submission.
- B. Pre-Functional Checklist requirements
 1. Four weeks prior to startup, the CMAR shall schedule startup and checkout with the Owner and Commissioning Agent. The performance of the Pre-functional Checklists, startup and checkout shall be directed and executed by the CMAR.
 2. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
 3. The CMAR shall execute startup and provide the Owner and Commissioning Agent with a signed and dated copy of the completed start-up, Pre-functional Checklists, and initial tests.
 4. Only individuals that have direct knowledge and witnessed that a line item task on the Pre-functional Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.3 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 21 shall be scheduled and documented in accordance with Section 01 00 00 General Requirements. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 FUNCTIONAL PERFORMANCE TESTING:

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Owner's Representative. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified

in the test procedure to perform the tests. The Commissioning Agent will direct and document the testing. The Contractor shall sign the test reports to verify tests were performed. The Functional testing will be conducted independently of the Authority Having Jurisdiction (AHJ) acceptance testing.

3.5 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Documentation: The Commissioning Agent will direct, witness, and document the results of all Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the OAR and the CMAR for review and approval.
- B. Non-Conformance: The Commissioning Agent will record the results of the Functional Performance Tests on the procedure or test form. All items of non-conformance issues will be noted and reported to the OAR on Commissioning Field Reports and/or the Commissioning Master Issues Log.
- C. Cost of Retesting: The cost to retest any portion of a Functional Performance Test or to validate deficiency resolution shall be solely the responsibility of the CMAR including the costs for the Commissioning Agent. Any required retesting by the CMAR shall not be considered a justified reason for a claim of delay or for a time extension by the CMAR.

3.6 DEFERRED TESTING

- A. Deferred Seasonal Testing: Deferred Seasonal Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The CMAR shall review and comment on the proposed schedule for Deferred Seasonal Testing. The OAR will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Functional Performances Tests shall be directed, witnessed, and documented by the Commissioning Agent. Deferred Seasonal Functional Performance Tests shall be executed by the CMAR in accordance with these specifications.

3.7 SYSTEMS DOCUMENTATION

- A. Turn over the following documentation to the Commissioning Agent for preparation of a Systems Manual:
 - 1. As-built control sequences of operation for all equipment/systems to be commissioned.
 - 2. Recommended schedule/frequency for recalibrating control sensors and actuators.

END OF SECTION 21 08 00

PROJECT SPECIFICATION

SECTION 21 11 00

FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 21 11 00 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes underground fire-suppression water-service piping from a point outside each building up through slab into each Fire Protection Room and Preaction Room as shown on the Underground Fire Protection plans.
- B. Materials specified in this Section include the following:
 - 1. PVC Schedule 40 solid core pressure pipe and fittings for all underground water service piping.
 - 2. Settlement joints for pressure systems.

1.3 HYDRAULIC CALCULATIONS

- A. Water hydraulic calculations shall be provided by the SLCPUC for Division 21 contractor to perform and complete sprinkler system calculations for each building.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing fire water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Water Service Piping, Below Ground: 175 psig.

1.4 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.
- B. SDR: Standard Dimension Ratio

1.5 SUBMITTALS

A. Action Submittals

1. Product Data: For each type of product.
2. Shop Drawings:
 - a. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

B. Informational Submittals

1. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
2. Field quality-control reports.

1.6 TRADE CONTRACTOR'S QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

C. Protect flanges, fittings, and specialties from moisture and dirt.

D. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

- A. Coordinate points of connection, invert elevation and pipe sizes with Civil Engineer prior to commencing work.

PART 2 - PRODUCTS

2.1 PVC SDR PRESSURE PIPE AND FITTINGS

- A. General: All PVC fire water service pipe shall have a pressure class (PC) of 305 psi (FM approved for 200 psi), DR 14 and meets AWWA C900 Standards.
- B. Pipe: All PVC (SDR PR Series) pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D2241, consistently meeting and/or exceeding the Quality Assurance test requirements of this standard with regard to pressure rating, material, workmanship, burst pressure, flattening, impact resistance, and extrusion quality. The pipe shall be manufactured in the USA, using domestic materials, by an ISO 9001 certified manufacturer. All pipe shall be stored indoors after production at the manufacturing site until shipped from factory. This pipe shall carry the National Sanitation Foundation (NSF) seal of approval for potable water applications. Pipe shall be meet AWWA C900 DR 14pressure Class 305 psi
- C. Fittings: PVC fabricated fittings shall be made from PVC resin that has been compounded to provide physical and chemical properties that equal or exceed cell class 12454 as defined in ASTM D1784, Fittings shall be fabricated from pipe materials that qualify for a minimum hydrostatic design basis of 4,000 psi in accordance with PPI TR-3. Fittings shall be made from PVC that meets or exceeds AWWA C900 pressure pipe or AWWA C905 pressure pipe.
- D. Joints: Bell and spigot push-on gasketed joint: Elastomeric Gaskets is compressed between the pipe spigot and bell to form a positive seal: One gasket shall be furnished with each bell of every fitting. Elastomeric gaskets shall meet the requirements of ASTM F477 for high head (50 feet of head or higher applications).
- E. Pressure Pipe Joint Lubricant: The lubricant used for joint assembly shall be water soluble lubricating agent which will not support bacteria growth and not be detrimental to the gasket material or pipe. Only gaskets and lubricants that are compatible with PVC shall be used. The gaskets and lubricates shall be compatible with one another when used together.
- F. Fabricated Fitting Overwrap Reinforcement: PVC shall be applied by the manufacturer to meet the requirements of this standard specification.
 - 1. Resin: Resin used shall be a commercial grade of unsaturated polyester resin or epoxy resin.
 - 2. Glass: Glass reinforcing materials shall be commercial "E" type glass in the form of mat, continuous roving or roving fabric or a combination of these, having a coupling agent that bonds the glass reinforcement and the resin.

2.2 SETTLEMENT JOINTS (PRESSURE SYSTEMS)

- A. Settlement joints shall be installed in the locations as indicated on the Fire Protection Drawings.
- B. Settlement flexible joint shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53. Foundry certification of material shall be provide with close-out submittals.
- C. Each flexible settlement joint shall be pressure tested prior to shipment against its own restraint to a minimum of 250psi. A minimum 2:1 safety factor determined from the published pressure rating shall apply.
- D. Each flexible settlement joint shall consist of an expansion joint designed and cast an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of 25 degree, 4"-8" and 8-inches minimum expansion. The flexible expansion fitting shall not expand or exert an axial imparting thrust under internal water pressure. The flexible expansion fitting shall not increase or decrease the internal water volume as the unit expands or contracts.
- E. All internal surfaces (wetted) parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating shall meet ANSI/NSF-61.
- F. All exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.
- G. Polyethylene sleeves, meeting ANSI/AWWA C105/A21.5, shall be included for direct buried applications.
- H. Manufacturer's certification of compliance to the above standards and requirements shall be provided as part of the O & M Manuals. The Owner shall reserve the right to inspect the manufacturer's facility for compliance.
- I. All settlement joints shall be The Force Balanced Flex-Tend as manufactured by EBAA Iron, Inc., Eastland Texas or an approved equal.

PART 3 - EXECUTION

3.1 EXCAVATING, TRENCHING, AND BACKFILLING (EARTHWORK)

- A. Comply with the requirements of Civil Site Utilities specification sections.
- B. In absence of specific earthwork requirements, comply with the following :
 - 1. Perform excavation, dewatering, shoring, bedding and backfill required for installation of work in this Division in accordance with the provisions of related earthwork sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - 2. Do not excavate under footings, foundation bases or retaining walls (Comply with structural details.)

3. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
4. Provide a settlement joint (pressure type) for each incoming fire water service at each building as indicated on the Underground Plumbing Plans
5. Excavation: Do not excavate under footings, foundations bases or retaining walls.
6. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of the underground systems materials.
7. Install all underground fire water service piping, per "PVC Handbook of Pipe Installation."

3.2 PIPING INSTALLATION

- A. The embedment requirements for PVC fire water service water pipe shall be in accordance with AWWA Standard C605 for "Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water."
- B. All service connections to PVC water pipe shall be made in accordance with the recommendations of AWWA C605.
- C. Install PVC, fire water-service piping according to AWWA 900 and PVC Installation Handbook.
- D. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated on the Underground Fire Protection Drawings.
 1. Terminate fire-suppression water-service piping within the building at the floor slab until building-fire water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
- E. Comply with requirements in Section 211315 "Wet-Pipe Sprinkler Systems," for fire-suppression-water piping inside the building.
- F. Install sleeves for piping penetrations of floors. Comply with requirements for sleeves specified in Section 210515 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- G. Install sleeve seals for piping penetrations of slabs. Comply with requirements for sleeve seals specified in Section 21 05 15 "Sleeves and Sleeve Seals for Fire Suppression Piping"

3.3 JOINT CONSTRUCTION

- A. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- B. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

- C. Do not use flanges or unions for underground piping.

3.4 SETTLEMENT JOINT INSTALLATION

- A. Provide in locations as indicated on the Fire Protection Underground Drawings.
- B. Provide to the OAR a written report that all settlement joints have been installed per manufacturer's recommendations prior to being covered. The written report shall include the manufacturer's representative sign-off of each settlement joint installation.
- C. Install settlement joints per manufacturers' recommendation.
- D. Manufacturers' representative shall provide a 4-hour class to Contractor on installation of settlement joints prior to commencing work

3.5 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Heat-fused joints.
 - 6. Pipe clamps and tie rods.

3.6 FIELD QUALITY CONTROL

- A. Use pipe test procedure prescribed by NFPA procedures and guidelines and/or by authorities having jurisdiction.
- B. Contractor shall certify to the OAR with a written report that all settlement joints have been installed per manufacturer's recommendation prior to being covered. In addition, the written report shall include the manufacturer's representative sign-off who witnessed the installation of each settlement joint.
- C. Prepare test and inspection reports.

3.7 IDENTIFICATION

- A. Provide detectable underground tape above all buried fire protection water service piping on the Project. Provide a continuous printed message repeated every 16 to 36 inches warning of pipe buried below similar to (i.e. "CAUTION FIRE PROTECTION WATER SERVICE LINE BURIED BELOW").

- B. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping.
- C. Comply with Section 21 05 50, "Identification for Fire Suppression Piping and Equipment."

3.8 CLEANING

- A. Clean fire water-service piping as follows:
 - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging activities.

3.9 TESTING

- A. Perform tests and inspections per NFPA 13 requirements.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

END OF SECTION 21 11 00

PROJECT SPECIFICATION

SECTION 21 13 15

WET-PIPE SPRINKLER SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

4	01.07.20	FCR 0666
3	03.17.17	Bulletin 04
2	08.18.16	Bulletin 01
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 21 13 15 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Review the documents for coordination with additional requirements and information that apply to work under this Section.
- C. All work shall be designed and installed in accordance with contract drawings, specifications, applicable codes and Salt Lake City Fire Marshal.
- D. Jensen Hughes Fire Protection Report/Code Summary (Construction Documents Phase) shall apply to this Section.

1.2 STANDARDS AND CODES

- A. Provide an automatic sprinkler systems conforming to the requirements of the listed editions of the following publications including all amendments to these publications:
 - 1. National fire Protection Association (NFPA)
 - a. 2010 NFPA 13 (Standard for Installation of Automatic Sprinkler system)
 - b. 2010 NFPA 14 (Standard for Installation of standpipe and Hose Systems)
 - c. 2010 NFPA 25 (Standard for Inspection, Testing and Maintenance of Water Based fire Protection Systems)
 - d. 2011 NFPA 70, National Electrical Code
 - e. 2010 NFPA 415 (Standard on Airport Terminals Buildings, Fueling Ramp drainage and Loading Walkways)
 - f. 2012 International Building Code
 - g. 2012 International Fire Code
 - h. Requirements of authority having jurisdiction (AHJ).
 - i. Applicable local and State of Utah codes
 - j. Underwriters Laboratories (UL)

1.3 DESCRIPTION OF WORK

- A. This work includes the design and installation of a new automatic sprinkler system as described herein and on the contract documents for the Terminal (includes Sector A of South Concourse East); South Concourse West (SCW); and Gateway Buildings.
- B. The system design and installation shall include all piping, valves, sprinklers, fittings, hangers, alarm devices, backflow preventers; inspector's test connections, fire department connections, hose connections all accessories and miscellaneous items required for a complete operating system even if items is not specifically described herein.

- C. Project design drawings and specifications reflect the intent and scope of the project and main pipe routing. The Contractor is responsible for the design of the systems. The Contractor shall provide a fire sprinkler system that meets all the requirements stated herein. The Contractor may vary from the design drawings provided all of the requirements are satisfied. Drawings indicate routing of all sprinkler mains and risers and location of beam penetrations. Additional beam penetrations must be coordinated and approved by structural engineer prior to commencing work. Contractor is expected to make allowances for all necessary adjustments for the actual system(s) installation and to examine physical conditions which may affect the performance of their work prior to commencing work and coordinate the actual pipe routing as necessary to accommodate the conditions, obstructions and work of others. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Architect and OAR for clarification prior to submission of base bid price.
- D. Sprinkler heads shall be spaced, located and positioned as shown on the Architectural reflected ceiling plans, where shown, as specified herein and as required to suite building partition layout according to NFPA 13. Where head layouts shown on the Architectural reflected ceiling plans are more stringent than the NFPA 13 requirements, the more stringent requirements shall apply. The omission of any necessary system component shall not relieve the Contractor of the responsibility for providing such necessity, without additional cost to the Owner. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Architect for clarification prior to the bid due date.
- E. The Contractor shall provide all devices and equipment required by these Specifications, Drawings and the Salt Lake City Fire Marshal, and NFPA. Under no circumstances will the Contractor delete any equipment or devices without written directive of the Salt Lake City Fire Marshal.
- F. Authority Having Jurisdiction: Any reference in the Specifications or applicable to the "authority having jurisdiction" (AHJ) shall be interpreted to mean the Salt Lake City Fire Marshal.
- G. Installation of the fire suppression system shall not be started until all signed and sealed Fire Protection drawings have been approved and stamped by the Salt Lake City Fire Marshal.
- H. Repair Service/Replacement Parts: repair services and replacement parts for the system shall be furnished under this contract and be available for a period of 5 years after the date of final acceptance by SLCFM.
- I. Within thirty (30) days after the start of construction, the Contractor shall evaluate the water supply for the existence of microorganisms and microbes that may contribute to Microbiologically Influenced Corrosion (MIC). The results of the test shall be submitted to the OAR, Architect and Engineer of Record within 15 days of completion of the test. If the results are found to contribute to MIC, the Contractor shall develop a treatment plan, submit to the OAR, architect and Engineer of Record and meet with these parties to review the treatment plan.
- J. Related Sections:
 - 1. Section 211120 "Fire-Department Connections" for exposed flush mounted to building exterior, and fire-department connections.
 - 2. Section 211205 "Fire-Suppression Standpipes" for standpipe piping .

1.4 HYDRAULIC CALCULATIONS

- A. Hydraulic calculations shall be prepared in accordance with NFPA 13.
- B. Water hydraulic calculations shall be provided by the SLCPUC for Division 21 contractor to perform and complete sprinkler system calculations for each building.

1.5 ABBREVIATIONS

- A. AHJ: Authority Having Jurisdiction.
- B. SLCFM: Salt Lake City Fire Marshal.
- C. OAR: Owner's Authorized Representative.
- D. SCE: South Concourse East.
- E. SCW: South Concourse West
- F. SLCPUC: Salt Lake City Public Utility Commission
- G. NFPA: National Fire Protection Agency.
- H. NICET: National Institute for Certification in Engineering Technologies.
- I. UL: Underwriters Laboratories.

1.6 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

1.7 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
- B. Performance Based Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified NICET Level III or Level IV Certified Technician or a professional fire protection engineer licensed in the State of Utah, using performance requirements and design criteria indicated.
 - 1. Fire protection contractor shall obtain water hydraulic calculations from the SLCPUC for each building as required to complete each building sprinkler hydraulic calculations.
- C. Sprinkler system design shall be approved by SLCFM and/or AHJ prior to commencing work.

1. Division 21 Contractor shall comply with Jensen Hughes Fire Protection Report/Code Summary (Construction Documents Phase).
 2. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 3. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - e. Office Areas: Light Hazard.
 - f. Baggage, Packing and Mail Handling Areas: Ordinary Hazard Group 2
 - g. Passenger Areas: Ordinary Hazard Group 1.
 4. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 5. Maximum Protection Area per Sprinkler: Per UL listing.
 - a. Office Spaces: 225 sq. ft. per head
 - b. Passenger handling Areas 130 sf per head
 - c. Storage Areas: 130 sq. ft. per head
 - d. Mechanical Equipment Rooms: 130 sq. ft per head
 - e. Electrical Equipment Rooms: No sprinklers, 2 hour rated construction
 - f. Switchgear Rooms: No sprinklers, 2 hour rated construction
 - g. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
 6. 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.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.8 SUBMITTALS

A. Action Submittals

1. Product Data: cut sheets marked to clearly indicate all fire protection materials, accessories and manufacturers to be used, including but not limited to test/drain assemblies, pipe and fittings, pipe hangers, valves, sprinkler heads, specialties, water flow switches, valve

supervisory switches and other required materials. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14 and NFPA 24 for approval of all equipment to be constructed and installed. Shop Drawings shall identify all materials and list all equipment to be used. Shop drawings shall include reflected ceiling plans and shall be coordinated with other trades prior to submittal review. Final fire protection system shop drawings showing all piping sizes, beam penetrations, elevations, sprinkler head types and hydraulic calculations. Drawings shall be signed and stamped by Fire Protection engineer licensed in the state of Utah and signed and stamped approved by Salt Lake City Fire Marshal prior to being submitted. Include plans, elevations, sections, details, and attachments to other work. Shop drawings shall conform to "Working Plans" per NFPA 13 and per AHJ requirements.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Provide cut sheets of electric driven fire pump, jockey pump, controllers and accessories, pump curves, power and control diagrams.
4. Samples of sprinkler heads to be furnished.
5. Performance Based Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by NICET Level III or Level IV Professional or a licensed fire protection engineer in the State of Utah responsible for their preparation.
6. Water Hydraulic calculations for each building shall be provided by the SLCPUC for Division 21 contractor to perform sprinkler system calculations.
7. Hydraulic calculations for sprinkler systems shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Provide 10% safety factor for all sprinkler system calculations.

B. Informational Submittals

1. Coordination Drawings: Comply with the requirements of Division 01. 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:
 - a. Domestic water piping; sanitary waste and vent piping; grease waste and vent piping; cooking oil waste piping; condensate drain piping
 - b. HVAC hydronic piping and HVAC ductwork, and all Air Handling Equipment.
 - c. Items penetrating finished ceiling include the following:
 - 1) Lighting fixtures.
 - 2) Air outlets and inlets.
 - d. Baggage Handling System and Equipment.

2. Qualification Data: For qualified Installer and project engineer of record.
 3. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved signed and stamped by engineer of record and by authorities having jurisdiction, including hydraulic calculations if applicable.
 4. Welding certificates.
 5. Fire-hydrant flow test report or SLCPUC hydraulic calculations.
 6. 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."
 7. Field quality-control reports.
- C. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals. In addition to other items required include the following:
1. Provide all records of inspections, testing and maintenance reports to OAR in accordance with NFPA 13 and 25.
 2. Provide the OAR with all literature and instructions provided by the manufacturer describing the operation and maintenance of equipment and devices installed. This shall include, but not limited to the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 3. Manufacturer's required maintenance related to system warranty requirements.
 4. As-built Drawings.

1.9 TRADE CONTRACTOR'S QUALITY ASSURANCE

- A. Provide design, materials and all devices for a wet pipe automatic sprinkler system, complete, conforming to NFPA 13. All components of the system shall be current design and shall be regular and recurrent production. All equipment supplied shall be first quality and the manufacturer's best type and latest model capable of complying with all requirements of this specification and shall have been in continuous production for at least one year. Obsolete equipment shall not be used.
- B. Approved Equipment: Provide materials, equipment and devices that have been tested by a nationally recognized testing laboratory and listed or approved for fire protection service when required by NFPA 13 or this specification.
- C. Installer Qualifications:
1. Installer's responsibilities include designing, fabricating and installing sprinkler systems, the preparation of hydraulic calculations, installation drawings, shop drawings, as-built drawings and providing professional engineering services needed to assume engineering responsibility. Base hydraulic calculations on results of fire hydrant flow test or SLCPUC hydraulic calculations.

2. Sprinkler system installation shall be supervised by a system technician who is certified by a NICET as an engineering technician with a minimum Level III or Level IV certification in automatic sprinkler systems or a Fire Protection Engineer.
3. 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.
4. The fire protection system shall be designed and installed by a fire protection contractor who is licensed by the State of Utah to perform fire protection work of this type specified for this project. The fire protection contractor shall have a minimum of 5 years of experience in the installation of fire protection work of projects of this type.

1.10 EXTRA MATERIALS

- A. ~~Refer to Division 01 Section 017846 for Maintenance Material Stock. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.~~
- ~~1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project. Install sprinkler cabinets in each Fire Protection Room.~~

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Black-Steel Pipe: Schedule 40 ASTM A 53/A 53M, Type E, Grade B. in sizes 8-inches and smaller Pipe ends may be factory or field formed to match joining method.
- a. Piping 2" and smaller: Threaded ends.
 - b. Piping 2-1/2" and larger: Welded or grooved joints.
- B. Schedule 10, Black-Steel Pipe: ASTM A 135, Type E, Grade A or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller;
- a. Piping 1"-thru-5": Welded joints or grooved joints
- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamed steel pipe with threaded ends.
- D. Uncoated, Steel Couplings: ASTM A 865, threaded.
- E. Uncoated, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Malleable-Iron Unions: UL 860.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

- I. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company, No other manufacturer acceptable.
 - 2. Pressure Rating: 175 psig (1200 kPa) minimum.
 - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- J. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company, No other manufacturer acceptable

2.2 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).
- B. Ball Valves:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. Nibco
 - b. Appollo.

2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends and vinyl covered handle or ductile-iron body with grooved ends.
5. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Milwaukee Valve Company or comparable product by one of the following:
 - a. Fivalco Inc.
 - b. Global Safety Products, Inc.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron Butterfly Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Milwaukee Valve Company or comparable product by one of the following:
 - a. Anvil International, Inc.
 - b. Fivalco Inc.
 - c. Global Safety Products, Inc.
 - d. Kennedy Valve; a division of McWane, Inc.
 - e. NIBCO INC.
 - f. Pratt, Henry Company.
 - g. Shurjoint Piping Products.
 - h. Tyco Fire & Building Products LP.
 - i. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Cast or ductile iron.
5. End Connections: Grooved.

E. Check Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Milwaukee Valve Company or comparable product by one of the following:
 - a. AFAC Inc.
 - b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - c. Anvil International, Inc.
 - d. Clow Valve Company; a division of McWane, Inc.
 - e. Crane Co.; Crane Valve Group; Crane Valves.
 - f. Crane Co.; Crane Valve Group; Jenkins Valves.
 - g. Crane Co.; Crane Valve Group; Stockham Division.

- h. Fire-End & Croker Corporation.
 - i. Fire Protection Products, Inc.
 - j. Fivalco Inc.
 - k. Globe Fire Sprinkler Corporation.
 - l. Groeniger & Company.
 - m. Kennedy Valve; a division of McWane, Inc.
 - n. Matco-Norca.
 - o. Metraflex, Inc.
 - p. Mueller Co.; Water Products Division.
 - q. NIBCO INC.
 - r. Potter Roemer.
 - s. Reliable Automatic Sprinkler Co., Inc.
 - t. Shurjoint Piping Products.
 - u. Tyco Fire & Building Products LP.
 - v. United Brass Works, Inc.
 - w. Venus Fire Protection Ltd.
 - x. Victaulic Company.
 - y. Viking Corporation.
 - z. Watts Water Technologies, Inc.
- 2. Standard: UL 312.
 - 3. Pressure Rating: 250 psig (1725 kPa) minimum.
 - 4. Type: Swing check.
 - 5. Body Material: Cast iron.
 - 6. End Connections: Flanged or grooved.
- F. Bronze OS&Y Gate Valves:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Milwaukee Valve Company or comparable product by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. NIBCO INC.
 - d. United Brass Works, Inc.
 - 2. Standard: UL 262.
 - 3. Pressure Rating: 175 psig (1200 kPa).
 - 4. Body Material: Bronze.
 - 5. End Connections: Threaded.
- G. Iron OS&Y Gate Valves:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Milwaukee Valve Company or comparable product by one of the following:
 - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - b. American Valve, Inc.
 - c. Clow Valve Company; a division of McWane, Inc.
 - d. Crane Co.; Crane Valve Group; Crane Valves.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.

- g. Hammond Valve.
 - h. Mueller Co.; Water Products Division.
 - i. NIBCO INC.
 - j. Shurjoint Piping Products.
 - k. Tyco Fire & Building Products LP.
 - l. United Brass Works, Inc.
 - m. Watts Water Technologies, Inc.
 - 2. Standard: UL 262.
 - 3. Pressure Rating: 250 psig (1725 kPa) minimum.
 - 4. Body Material: Cast or ductile iron.
 - 5. End Connections: Flanged or grooved.
- H. Indicating-Type Butterfly Valves:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Milwaukee Valve Company or comparable product by one of the following:
 - a. Anvil International, Inc.
 - b. Fivalco Inc.
 - c. Global Safety Products, Inc.
 - d. Kennedy Valve; a division of McWane, Inc.
 - e. NIBCO INC.
 - f. Shurjoint Piping Products.
 - g. Tyco Fire & Building Products LP.
 - h. Victaulic Company.
 - 2. Standard: UL 1091.
 - 3. Pressure Rating: 175 psig (1200 kPa) minimum.
 - 4. Valves NPS 2 (DN 50) and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
 - 5. Valves NPS 2-1/2 (DN 65) and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
- I. NRS Gate Valves:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO INC or comparable product by one of the following:
 - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - b. American Valve, Inc.
 - c. Clow Valve Company; a division of McWane, Inc.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Kennedy Valve; a division of McWane, Inc.

- f. Mueller Co.; Water Products Division.
- g. Tyco Fire & Building Products LP.
- 2. Standard: UL 262.
- 3. Pressure Rating: 250 psig (1725 kPa) minimum.
- 4. Body Material: Cast iron with indicator post flange.
- 5. Stem: Nonrising.
- 6. End Connections: Flanged or grooved.

2.4 TRIM AND DRAIN VALVES

A. General Requirements:

- 1. Standard: UL's "Fire Protection Equipment Directory" listing.
- 2. Pressure Rating: 175 psig (1200 kPa) minimum.

B. Angle Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire Protection Products, Inc.
 - b. United Brass Works, Inc.

C. Ball Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Affiliated Distributors.
 - b. Anvil International, Inc.
 - c. Barnett.
 - d. Conbraco Industries, Inc.; Apollo Valves.
 - e. Fire-End & Croker Corporation.
 - f. Fire Protection Products, Inc.
 - g. Flowserve.
 - h. FNW.
 - i. Jomar International, Ltd.
 - j. Kennedy Valve; a division of McWane, Inc.
 - k. Kitz Corporation.
 - l. Legend Valve.
 - m. Metso Automation USA Inc.
 - n. Milwaukee Valve Company.
 - o. NIBCO INC.
 - p. Potter Roemer.
 - q. Red-White Valve Corporation.
 - r. Southern Manufacturing Group.
 - s. Stewart, M. A. and Sons Ltd.
 - t. Tyco Fire & Building Products LP.

- u. Victaulic Company.
- v. Watts Water Technologies, Inc.

2.5 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory".
2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - b. High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

2.6 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. National Fittings, Inc.
 - c. Shurjoint Piping Products.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.
2. Standard: UL 199.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Triple R Specialty.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CECA, LLC.
 - b. Corcoran Piping System Co.

- c. Merit Manufacturing; a division of Anvil International, Inc.
 - 2. Standard: UL 1474.
 - 3. Pressure Rating: 250 psig (1725 kPa) minimum.
 - 4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
 - 5. Size: Same as connected piping.
 - 6. Length: Adjustable.
 - 7. Inlet and Outlet: Threaded.
- F. Flexible, Sprinkler Hose Fittings:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fivalco Inc.
 - b. FlexHead Industries, Inc.
 - c. Gateway Tubing, Inc.
 - d. Victaulic Company.
 - 2. Standard: UL 1474.
 - 3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 - 4. Pressure Rating: 175 psig (1200 kPa) minimum.
 - 5. Size: Same as connected piping, for sprinkler.

2.7 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Viking Corporation
 - 2. Tyco Fire & Building Products LP.
 - 3. Victaulic Company.
 - 4. Reliable Company
- B. General Requirements:
- 1. Standard: UL's "Fire Protection Equipment Directory".
 - 2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
- C. Fire Sprinkler Heads:
- 1. All sprinklers shall be quick response throughout the entire project. Sprinklers shall have a temperature classification of 155 and 212 deg F per NFPA 13. Fire sprinklers shall be of one manufacturer throughout each building. Sprinklers shall be of all brass body construction with a metal Belleville spring seal coated on both sides with teflon film. Sprinklers utilizing non-metal parts in the sealing portion of the sprinkler are strictly prohibited. Sprinkler types to be installed shall be as follows:

2. Terminal; SCW; and Gateway Buildings:

- a. Sprinklers to be installed through a ceiling shall be concealed pendant with a push-on cover plate with white finish.
- b. Sprinklers to be installed through a lay-in ceiling shall be concealed pendant with a push-on cover plate with white finish.
- c. All sprinklers located in areas with no ceilings or areas with exposed piping shall be upright type with rough brass finish.
- d. All sprinklers located with no ceilings or above ceilings, in and around baggage handling systems shall be upright or pendant rough brass with sprinkler guard.
- e. Sprinklers for Hold Rooms located in the Terminal Building shall be institutional pendant type.

D. Sprinkler Finishes:

1. Chrome plated for concealed sprinkler heads
2. Rough brass for exposed sprinkler heads

E. Cover Plates for Ceilings:

1. White push-on.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Tyco Fire & Building Products LP.
 - b. Viking Corporation.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.
4. Provide sprinkler guards in all mechanical rooms, plumbing room, fire protections room and loading dock areas.

2.8 UL LISTED FLEXIBLE EXPANSION LOOP

- A. All sprinkler pipe passing through or crossing building seismic joints, shall contain a flexible expansion loop, designed for seismic movement. Flexible loops shall impart no thrust loads to building structure.

- B. Loops shall be located at, or near, the building seismic joint. Seismic bracing shall not pass through building seismic joint and shall not connect or tie together different sides or parts of building structure. Flexible loops shall be capable of movement in the 4"X, 4"Y, 4"Z planes. Movement requirements and location, relative to seismic separation, shall be determined by system design engineer. Flexible loops may be installed to accommodate thermal expansion, seismic movement, and building settlement. Unless specified otherwise by system design engineer or governing codes, all flexible loop connections to sprinkler piping shall be installed, inspected, and tested in accordance with current NFPA-13 standards.
- C. Flexible loops shall consist of two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return. Loops shall include a factory supplied, center support nut located at the bottom of the 180 degree return, and a drain/air release plug. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection fittings. Flexible expansion/seismic loops to be "Metraloop(r) Fireloop(tm) as manufactured by The Metraflex Company, Chicago(r), IL

2.9 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Notifier; a Honeywell company.
 - c. Potter Electric Signal Company.
 - 2. Standard: UL 464.
 - 3. Type: Vibrating, metal alarm bell.
 - 4. Size: 8-inch (200-mm) minimum- diameter.
 - 5. Finish: Red-enamel factory finish, suitable for outdoor use.
- C. Water-Flow Indicators:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Watts Industries (Canada) Inc.
 - 2. Standard: UL 346.
 - 3. Water-Flow Detector: Electrically supervised.

4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig (1725 kPa).
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Barksdale, Inc.
 - c. Detroit Switch, Inc.
 - d. Potter Electric Signal Company.
 - e. System Sensor; a Honeywell company.
 - f. Tyco Fire & Building Products LP.
 - g. United Electric Controls Co.
 - h. Viking Corporation.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.10 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMETEK; U.S. Gauge Division.
 2. Ashcroft, Inc.

3. Brecco Corporation.
 4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
- D. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

2.11 BACKFLOW PREVENTION ASSEMBLY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMES Fire & Waterworks: a division of Watts Water Technologies, Inc.
 2. Watts Water Technologies, Inc
 3. Zurn Plumbing Products Group; Wilkens Water Control Products Division.
- B. General: Each valve shall have a drain. Backflow prevention assemblies shall be UL listed. Include a test assembly for full forward flow testing
- C. All backflow assemblies shall be double-check, back-flow prevention assemblies.
- D. All backflow assemblies for incoming fire water service into each preaction room shall be installed in vertical configuration.

2.12 VALVE SUPERVISORY SWITCHES

- A. All valves that affect the flow of the fire protection water to the wet fire suppression system shall be supervised.
- B. Supervisory switches shall be furnished and installed by this Contractor and wired by Division 28 Contractor. Coordinate wiring of all switches with Division 28.

2.13 WATERFLOW SWITCHES

- A. Water flow switches with adjustable retard feature shall be provide in the supply pipe to each zone for remote alarm. Switch shall be double-pole single throw type and shall be rated at least 7 amperes at 125/250 volts

2.14 BUILDING FIRE ALARM SYSTEM INTERFACE

- A. Each zone control assembly shall provide an alarm signal output to the Building Fire Alarm System (wiring by Division 28) whenever there is waterflow in the zone.
- B. Each valve which controls the flow of sprinkler system water shall be monitored by the Building Fire Alarm System (wiring by Division 28).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Connect fire water piping to water-service piping for service entrance to building.
- B. Install, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.
- D. Comply with requirements of Section 21 11 00, "Facility Fire Suppression Water Service Piping".

3.3 PIPING INSTALLATION

- A. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- B. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.

- H. Not all sprinkler piping can be emptied by drains. Some sections may require the use of buckets or drums.
- I. Install all piping plumb, level (where applicable), and parallel/perpendicular to building lines.
- J. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- K. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- L. Install alarm devices in piping systems.
- M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) 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.
- O. Pressurize and check pre-action sprinkler system piping and air compressors.
- P. Fill sprinkler system piping with water.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210515 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210515 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210520 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

- A. Install flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- I. 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.
- J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
3. Deluge Valves: Install in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.7 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections per NFPA 13 requirements.
- B. Tests and Inspections:
 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 4. Energize circuits to electrical equipment and devices.
 5. Coordinate with fire-alarm tests. Operate as required.
 6. Coordinate with fire-pump tests. Operate as required.
 7. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.

- B. Remove and replace sprinklers with paint other than factory finish.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

END OF SECTION 211315

PROJECT SPECIFICATION

SECTION 26 05 30

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 26 05 30 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
 - 3. Embeds
- B. Related Sections include the following:
 - 1. Section 260549 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.
 - 2. Section 014600 "Seismic Design Requirements for Nonstructural Systems"
 - 3. Section 077200 "Roof Accessories"
 - 4. Section 055000 "Metal Fabrications"
 - 5. Section 033010 "Cast-in-Place Concrete"
 - 6. Section 036510 "Post-Installed Anchors"

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Performance Based Design: Design equipment supports, including comprehensive engineering analysis by a qualified professional engineer licensed in the state of Utah, capable of withstanding the effects of gravity and seismic loads in accordance with the 2012 IBC. Gravity loading shall include the combined operating weight of supported equipment and connected systems and components. Review structural drawings for attachments and load limits to primary

structure. See Section 014600 "Seismic Design Requirements for Nonstructural Systems." Obtain approval from authorities having jurisdiction.

- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads required for this Project by applicable Code.

1.5 SUBMITTALS

A. Action Submittals

1. Product data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.
2. Performance Based Design Submittal: Signed and sealed by a qualified professional engineer registered in the state of Utah. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - a. Trapeze hangers.
 - b. Metal framing systems.
 - c. Equipment supports.
3. Submit an electronic file in format able to be scaled and combined with other similar files, of the bracing and hanging point loads to the Structural Engineer of Record for review. The point loads shall indicate magnitude, direction, type of load (dead, live, seismic, etc.) and be keyed to the method of attachment details.

B. Information Submittals

1. Qualification Data: For professional engineer.
2. Welding certificates.

1.6 TRADE CONTRACTOR'S QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a Nationally Recognized Testing Laboratory as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Coordinate anchor bolt type and method of installation. Concrete, reinforcement, and formwork requirements are indicated on the drawings.

- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 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. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Flex-Strut Inc.
 - e. GS Metals Corp.
 - f. G-Strut.
 - g. Haydon Corporation.
 - h. Metal Ties Innovation.
 - i. Thomas & Betts Corporation, a Member of the ABB Group.
 - j. Unistrut; an Atkore International company.
 - k. Wesanco, Inc.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. G-Strut.
 - e. Haydon Corporation.
 - f. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 3. Fitting and Accessory Materials: Same as channels and angles.
 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. 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.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Power-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used. Refer to Section 036510 "Post-Installed Anchors" for additional requirements.
 2. 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. Refer to Section 036510 "Post-Installed Anchors" for additional requirements.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 4. Cast in Place, Internally Threaded Embeds: Anchors are cast into the underside of concrete deck after being fastened to the top of wood forms or metal deck.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Caddy / Erico
 - 2) Powers Fasteners
 - 3) Simpson Strong-Tie Company Inc.
 5. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 6. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 7. Toggle Bolts: All-steel springhead type.
 8. Hanger Rods:
 - a. Interior - threaded carbon steel.
 - b. Exterior – zinc coated, threaded carbon steel.

2.2 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 Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 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 (6 mm) 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 single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- C. 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 or concrete embeds.

3. To Masonry Embedded Anchors: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 - a. Instead of expansion anchors, power-actuated driven threaded studs provided with lock washers and nuts may be used in accordance with Section 036510 "Post-Installed Anchors".
 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 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 racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars, post-tension cables, mechanical piping, etc. in concrete slabs.
- E. Do not use post-installed anchors or fasteners in post tensioned slabs and beams without prior approval from the Engineer. Raceways shall be supported via attachment to concrete inserts.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "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.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) wider on each side of equipment, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Concrete bases to be constructed flat on top when checked with a straight edge.
- B. Use normal weight concrete, 3000-psi (20.7-MPa) minimum, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033010 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" 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.

3.6 OWNER'S QUALITY ASSURANCE

- A. Owner's independent commissioning and witnessing agency will provide the following inspection services:
 - 1. Perform Special Inspections per Section 036510 "Post-Installed Anchors."

END OF SECTION 26 05 30

PROJECT SPECIFICATION

SECTION 26 05 34

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

<u>2</u>	01.07.20	FCR 0666
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 26 05 34 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
- B. Related Requirements:
 - 1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, vaults, and underground utility construction.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. EMT: Electrical metallic tubing.
- C. FMC: Flexible metal conduit.
- D. GRC: Galvanized rigid steel conduit.
- E. RNC: Rigid Nonmetallic Conduit
- F. IMC: Intermediate metal conduit.
- G. LFMC: Liquid-tight flexible metal conduit.

1.4 SUBMITTALS

- A. Action Submittals:

1. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
2. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
3. Samples: For wireways and surface raceways and for each color and texture specified, 12 inches (300 mm) long.

B. Informational Submittals:

1. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - a. Structural members in paths of conduit groups with common supports.
 - b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
2. Qualification Data: For professional engineer.
3. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - d. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
4. Source quality-control reports.

1.5 TRADE CONTRACTOR'S QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify OAR no fewer than seven days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without OAR's written permission.

1.7 EXTRA STOCK

B.A. Refer to Division 01 Section 017846 for Maintenance Material Stock.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Tube & Conduit; a part of Atkore International.
 2. Anamet Electrical, Inc.
 3. Electri-Flex Company.
 4. FSR Inc.
 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
 6. Republic Conduit.
 7. Robroy Industries.
 8. Southwire Company.
 9. Western Tube and Conduit Corporation.
 10. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.
 3. Arnco Corporation.
 4. CANTEX INC.
 5. CertainTeed Corporation.
 6. Electri-Flex Company.
 7. Kraloy.
 8. RACO; Hubbell.
 9. Spiraduct/AFC Cable Systems, Inc.
 10. Thomas & Betts Corporation, a Member of the ABB Group.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- I. RTRC: Comply with UL 1684A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- K. Fittings for LFNC: Comply with UL 514B.

- L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the Utah Administration Code, Rule 307-342.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. MonoSystems, Inc.
 - 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Moulded Products, Inc.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Lamson & Sessions.
 - 4. Niedax Inc.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the Utah Administration Code, Rule 307-342.

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. MonoSystems, Inc.
 - c. Panduit Corp.
 - d. Wiremold / Legrand.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated.
 - b. MonoSystems, Inc.
 - c. Panduit Corp.
 - d. Wiremold / Legrand.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Technologies Company.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.

4. Hoffman; a brand of Pentair Equipment Protection.
 5. Hubbell Incorporated.
 6. Kraloy.
 7. O-Z/Gedney; a brand of Emerson Industrial Automation.
 8. RACO; Hubbell.
 9. Robroy Industries.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
1. Material: Cast metal.
 2. Type: Fully adjustable.
 3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- L. Gangable boxes are allowed.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC, IMC, RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-80-PVC, concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed conduit, installed above 72 inches above finished floor and not subject to physical damage: EMT.
2. Exposed conduit installed at or below 72 inches above finished floor, or otherwise subject to physical damage: GRC.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in kitchens and damp or wet locations.

C. Minimum Raceway Size:

1. Above grade: 3/4-inch trade size.
2. Below slab-on-grade or below grade: 1-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. Comply with NEMA FB 2.10.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260530 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of four 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. On CMU walls in non-public spaces, run conduit exposed along CMU walls.
- I. On CMU walls in service and maintenance areas (electrical rooms, mechanical rooms, etc.) run conduit exposed along CMU walls.
- J. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- K. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from ENT to GRC or IMC before rising above floor.
 6. Install conduits as close as practical to the middle of the slab. Do not install conduits of diameter greater than 1/3 of the slab thickness. Space conduits not less than 3 diameters on centers, except at stub-up locations.
- L. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or GRC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. 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.
- N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. 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 (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. 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.
- S. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- U. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
 4. Install conduit penetrations of building walls as specified in Section 260545 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Y. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground GRC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) 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 (0.0115 mm per meter of length of straight run per deg C) 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.
- Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a rain-tight connection between box and cover plate or supported equipment and box.
- CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- DD. Locate boxes so that cover or plate will not span different building finishes.
- EE. 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.
- FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- GG. Set metal floor boxes level and flush with finished floor surface.
- HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 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 260545 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 34

PROJECT SPECIFICATION

SECTION 26 05 45

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 26 05 45 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Section 078413 "Penetration Fire-stopping" for penetration fire-stopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: For each type of product.
 - 2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber 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.
 - 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. HOLDRITE.

2.4 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079215 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete walls. Position waterstop flange to be centered in concrete wall.
- C. Assemble fitting components of length to extend 2" above finish floors and flush with bottom surfaces of concrete slabs. Position waterstop flange to be centered in concrete slab.

- D. Secure nailing flanges to concrete forms.
- E. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 OWNER'S QUALITY ASSURANCE

- A. Owner's independent commissioning and witnessing agency will provide the following witnessing and/or review services:
 - 1. Review all sleeve-seal system installations.

END OF SECTION 26 05 45

PROJECT SPECIFICATION

SECTION 26 05 49

SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 26 05 49 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Restraint channel bracings.
 - 2. Restraint cables.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.
 - 5. Adhesive anchors (Epoxy anchors).
- B. Related Requirements:
 - 1. Section 260530 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.
 - 2. Section 014600 "Seismic Design Requirements for Nonstructural Systems"
 - 3. Section 036510 "Post-Installed Anchor"

1.3 DEFINITIONS

- A. IBC: International Building Code, 2012 edition.
- B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

- A. Performance Based Design: Design seismic restraints and supports, including comprehensive engineering analysis by a qualified professional engineer licensed in the State of Utah, using performance requirements and design criteria indicated. Review structural drawings for attachments and load limits to primary structure. See Section 014600 "Seismic Design Requirements for Nonstructural Systems." Obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. ACTION SUBMITTALS
 - 1. Product Data: For each type of product.

- a. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component required.
 - 1) Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES or other evaluation service agency acceptable to authorities having jurisdiction.
 - 2) Annotate to indicate application of each product submitted and compliance with requirements.
2. Shop Drawings:
 - a. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Performance Based Design Submittal: For each seismic-restraint device.
 - a. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by a qualified professional engineer registered in the state of Utah.
 - b. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, seismic and wind forces required to select seismic and wind restraints and for designing vibration isolation bases.
 - 1) Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - c. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
 - d. Seismic and Wind Restraint Details:
 - 1) Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 - 2) Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their capacities, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - 3) Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - e. Submit an electronic file in a format able to be scaled and combined with other similar files, of the bracing and hanging point loads to the Structural Engineer of Record for review. The point loads shall indicate magnitude, direction, type of load (dead, live, seismic, etc) and be keyed to the method of attachment details.

B. Informational Submittals:

1. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
2. Qualification Data: For professional engineer.
3. Welding certificates.
4. Field quality-control reports.

1.6 TRADE CONTRACTOR'S QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a Nationally Recognized Testing Laboratory as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval by ICC-ES or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a professional engineer registered in the state of Utah.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 1. Refer to Section 014600 "Seismic Requirements for Nonstructural Systems".
 2. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES or other evaluation service agency acceptable to authorities having jurisdiction.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be in accordance with the IBC 2012.

2.2 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
 2. Hilti, Inc.
 3. Mason Industries, Inc.
 4. Unistrut; an Atkore International company.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kinetics Noise Control, Inc.
 2. Loos & Co., Inc.
 3. Vibration Mountings & Controls, Inc.
- B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.; a division of Cooper Industries.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
 4. TOLCO; a brand of NIBCO INC.
- B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Hilti, Inc.
 - 3. Kinetics Noise Control, Inc.
 - 4. Mason Industries, Inc.
- B. Mechanical Anchor Bolts: Refer to Section 035610 "Post-Installed Anchors". Provide zinc-coated steel anchors for interior applications and stainless steel for exterior applications. Select anchor bolts and embedment depths for strength required for anchor design loads and attachment substrate.

2.6 ADHESIVE ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hilti, Inc.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
- B. Adhesive Anchors: Refer to Section 035610 "Post-Installed Anchors". Provide anchors and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor design loads and attachment substrate and compatible with selected adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and approved by OAR.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES or other evaluation service agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods caused by seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete" Or 033015 "Cast-in-Place Concrete – Parking Garage."
- B. Equipment and Hanger Restraints:
 - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES or other evaluation service agency acceptable to authorities having jurisdiction providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at top flanges of beams, at upper truss chords of open web joists, or at concrete members.
- H. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Expansion Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened. Install in accordance with evaluation reports and the manufacturer's written instructions.
 4. Adhesive Anchors: Prepare substrate and install in accordance with evaluation reports and the manufacturer's written instructions.
 5. Refer to Section 036510 "Post-Installed Anchors" for additional requirements.
 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications and wet locations.
- I. Do not use post-installed anchors or fasteners in post tensioned slabs and beams. Raceways shall be supported via attachment to concrete insert.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, and wireways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment. Comply with requirements in section 014600 "Seismic Requirement for Nonstructural Systems."

3.5 TRADE CONTRACTOR'S QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with OAR, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test anchors in accordance with the requirements listed in Section 036510 "Post-Installed Anchors."
 5. For anchors not covered by Section 036510 "Post-Installed Anchors," test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - a. Test to 90 percent of rated proof load of device.
- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 OWNER'S QUALITY ASSURANCE

- A. Owner's independent commissioning and witnessing agency will provide the following inspections and/or review services:
 - 1. Perform Special Inspections per Section 036510 "Post-Installed Anchors."
 - 2. Review test and inspection reports.

3.7 ADJUSTING

- A. Coordinate and adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 49

PROJECT SPECIFICATION

SECTION 26 05 54

IDENTIFICATION FOR ELECTRICAL SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 26 05 54 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: For each electrical identification product indicated.
 - 2. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
 - 3. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 TRADE CONTRACTOR'S QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, 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.
- E. Coordinate with Owner's existing numbering / labeling system.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage, system and service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

2.4 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

2.6 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 3. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)." or as otherwise indicated and/or required.
 3. Arc Flash Warning: "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - a. Location designation.
 - b. Nominal voltage.
 - c. Flash protection boundary.
 - d. Hazard risk category.
 - e. Incident energy.
 - f. Working distance.
 - g. Engineering report number, revision number, and issue date.

2.7 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with black letters on white face or white letters on red face where indicated.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Minimum letter height shall be 3/8 inch (10 mm). Label and letter colors shall be as follows:
1. Normal Power:
 - a. White letters on a black field.
 - b. Legend: Indicate voltage.
 2. Standby Power (NEC 701 and 702):
 - a. White letters on blue field.

- b. Legend: Indicate voltage.
- 3. Emergency Power (NEC 700):
 - a. White letters on red field.
 - b. Legend: Indicate voltage.
- 4. UPS Power:
 - a. White letters on an orange field.
 - b. Legend: Indicate voltage.
- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.9 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F ((23 deg C)), According to ASTM D 638: 7000 psi (48.2 MPa).
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - 5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish 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 signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

- K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 20 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 25-foot (10-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Standby Power.
 - 3. Normal Power.
 - 4. UPS Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
 - D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
 - E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, vaults, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

- F. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
- G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power,

lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

- a. Indoor and Outdoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- c. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to be Labeled:

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
- b. Enclosures and electrical cabinets.
- c. Access doors and panels for concealed electrical items.
- d. Switchgear.
- e. Switchboards.
- f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- g. Emergency system boxes and enclosures.
- h. Enclosed switches.
- i. Enclosed circuit breakers.
- j. Enclosed controllers.
- k. Variable-speed controllers.
- l. Push-button stations.
- m. Power transfer equipment.
- n. Contactors.
- o. Remote-controlled switches, dimmer modules, and control devices.
- p. Battery-inverter units.
- q. Battery racks.
- r. Power-generating units.
- s. Monitoring and control equipment.
- t. UPS equipment.

END OF SECTION 26 05 54

PROJECT SPECIFICATION

SECTION 26 27 27

WIRING DEVICES

SALT LAKE CITY INTERNATIONAL AIRPORT

<u>2</u>	<u>01.07.20</u>	<u>FCR 0666</u>
1	05.13.16	Issue For Construction
REV.	DATE	ISSUANCE

SECTION 26 27 27 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Isolated-ground receptacles.
 - 4. Weather-resistant receptacles.
 - 5. Snap switches and wall-box dimmers.
 - 6. Wall-switch and exterior occupancy sensors.
 - 7. Pendant cord-connector devices.
 - 8. Cord and plug sets.
 - 9. Floor service outlets, poke-through assemblies, service poles, and multi-outlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 SUBMITTALS

A. Action Submittals:

1. Product Data: For each type of product.
2. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
3. Samples: One for each type of device and wall plate specified, in each color specified.

B. Informational Submittals:

1. Field quality-control reports.

C. Closeout Submittals:

1. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

~~D. Maintenance Material Submittals: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.~~

- ~~a. Service/Power Poles: One for every 10, but no fewer than one.~~
- ~~b. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.~~
- ~~c. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.~~

1.6 EXTRA STOCK

A. Refer to Division 01 Section 017846 for Maintenance Material Stock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
 - 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.

3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. EGS/Appleton Electric.
 - c. Killark.

2.6 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description:

- a. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
- b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - 2) Hubbell Incorporated; Wiring Device-Kellems.
 - 3) Leviton Manufacturing Co., Inc.
 - 4) Pass & Seymour/Legrand (Pass & Seymour).

2. Two Pole:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
- 2) Hubbell Incorporated; Wiring Device-Kellems.
- 3) Leviton Manufacturing Co., Inc.
- 4) Pass & Seymour/Legrand (Pass & Seymour).

3. Three Way:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
- 2) Hubbell Incorporated; Wiring Device-Kellems.
- 3) Leviton Manufacturing Co., Inc.
- 4) Pass & Seymour/Legrand (Pass & Seymour).

4. Four Way:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
- 2) Hubbell Incorporated; Wiring Device-Kellems.
- 3) Leviton Manufacturing Co., Inc.
- 4) Pass & Seymour/Legrand (Pass & Seymour).

C. Pilot-Light Switches, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
- b. Hubbell Incorporated; Wiring Device-Kellems.
- c. Leviton Manufacturing Co., Inc.
- d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
- b. Hubbell Incorporated; Wiring Device-Kellems.
- c. Leviton Manufacturing Co., Inc.

- d. Pass & Seymour/Legrand (Pass & Seymour).
- 2. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2.10 DECORATOR-STYLE DEVICES

- A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

- d. Pass & Seymour/Legrand (Pass & Seymour).
- C. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- D. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
 - 2. Description: With neon-lighted handle, illuminated when switch is "off."

2.11 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Back-of-House Finished Spaces: Steel with white baked enamel, suitable for field painting.
 - 3. Material for Public Spaces: Stainless steel.
 - 4. Material for Unfinished Spaces (normally unoccupied): Galvanized steel.
 - 5. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with hood for in-use application.

2.12 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with satin finish, as indicated on drawings.

- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Blank cover with bushed cable opening

2.13 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Pass & Seymour/Legrand (Pass & Seymour).
 - 3. Thomas & Betts Corporation, A Member of the ABB Group.
 - 4. Wiremold / Legrand.
- B. Description:
 - 1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channelled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 - 2. Comply with UL 514 scrub water exclusion requirements.
 - 3. Service-Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks complying with requirements in Section 271500 "Communications Horizontal Cabling."
 - 4. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 - 5. Closure Plug: Arranged to close unused 3-inch (75-mm) cored openings and reestablish fire rating of floor.
 - 6. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of two, four-pair cables that comply with requirements in Section 271500 "Communications Horizontal Cabling."

2.14 PREFABRICATED MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Wiremold / Legrand.
- B. Description:
 - 1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
 - 2. Two-channels with internal divider to isolate power from data.
 - 3. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Multi-Outlet Harness:

1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: 12 inches (300 mm).
3. Wiring: No. 12 AWG solid, Type THHN copper, two circuit, connecting alternating receptacles.

2.15 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

B. Wall Plate Color:

1. For Back-of-House Finished Spaces: As selected by Architect unless otherwise indicated.
2. For Public Spaces: Stainless steel.
3. For Unfinished Spaces (normally unoccupied): Galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
 2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multi-gang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260554 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use label maker adhesive with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 TRADE CONTRACTOR'S QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 OWNER'S QUALITY ASSURANCE

- A. Owner's independent commissioning and witnessing agency will provide the following witnessing and/or review services:
 - 1. Review of Contractor's test and inspection reports.

END OF SECTION 26 27 27

PROJECT SPECIFICATION

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEMS

SALT LAKE CITY INTERNATIONAL AIRPORT

3	12.15.16	Bulletin 03
2	08.18.16	Bulletin 01
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SECTION 283115 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Documents:
 - 1. Section 087100 "Door Hardware".
 - 2. Section 260526 "Grounding and Bonding for Electrical Systems".
 - 3. Section 260529 "Hangers and Supports for Electrical Systems".
 - 4. Section 260533 "Raceways and Boxes for Electrical Systems".
 - 5. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling".
 - 6. Section 260554 "Electrical Identification".

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Air-sampling smoke detectors.
 - 5. Heat detectors.
 - 6. Notification appliances.
 - 7. Addressable appliance SLC repeater (NAC Extenders).
 - 8. Magnetic door holders.
 - 9. Remote annunciator.
 - 10. Addressable interface device.
 - 11. Digital alarm communicator transmitter.
 - 12. Network communications.
 - 13. Network command graphical workstation.
 - 14. System printer.
 - 15. Device Guards.
- B. Related Requirements:
 - 1. Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.
 - 2. Section 21 13 35 "Double Interlock Preaction Systems".
 - 3. Section 25 01 30 "BAS Interface Requirements".

1.3 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
 - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
 - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 2010 Edition.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Detail assembly and support requirements.
 - 5. Include voltage drop calculations for notification-appliance circuits.
 - 6. Include battery-size calculations.
 - 7. Include input/output matrix.
 - 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
 - 9. Include performance parameters and installation details for each detector.
 - 10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
 - 12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Locate detectors according to manufacturer's written recommendations.
 - d. Show air-sampling detector pipe routing

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include copies of 11" x 17" laminated floor plans in each fire alarm control panel to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
15. Provide communication protocol details between Building Automation System and Fire Alarm System.

C. General Submittal Requirements:

1. Shop drawings shall be approved by the Architect prior to submitting them to the authorities having jurisdiction.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level IV.
 - c. Licensed or certified by authorities having jurisdiction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Sample Warranty: For Special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

- b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
- c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
- d. Riser diagram.
- e. Device addresses.
- f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
- g. Record copy of site-specific software.
- h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
- i. Manufacturer's required maintenance related to system warranty requirements.
- j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

- 1. Software operating and upgrade manuals.
- 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
- 3. Device address list.
- 4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Smoke Detectors: Quantity equal to 2 percent of amount of each type installed, but no fewer than 5 units of each type.
 - 2. Heat Detectors: Quantity equal to 2 percent of amount of each type installed, but no fewer than 5 units of each type.
 - 3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 5 units of each type.
 - 4. Keys and Tools: One extra set for access to locked or tamperproofed components.
 - 5. Audible and Visual Notification Appliances: Five of each type installed.
 - 6. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
 - 7. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
 - 8. Air-Sampling Fan: Quantity equal to two for every five detectors, but no fewer than one unit of each type.

9. Duct Detector Assembly: Quantity equal to at least one complete assembly, but no fewer than 1 unit of each type installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be approved by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be supervised by personnel certified by NICET as fire-alarm Level IV technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 2. Warranty Period: Five years from date of project Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Subject to compliance with requirements, provide fire alarm products from Tyco SimplexGrinnell only.
- C. Noncoded, FM Global-placarded addressable system, with multiplexed signal transmission and horn/strobe and speaker/strobe evacuation.
- D. Automatic sensitivity control of certain smoke detectors.
- E. All components provided shall be listed for use with the selected system.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Air-sampling smoke-detection system (VESDA).
- ~~5.6.~~ Carbon monoxide detectors.
- ~~6.7.~~ Automatic sprinkler system water flow.
- ~~7.8.~~ Preaction systems.
- ~~8.9.~~ Fire standpipe systems.
- ~~9.10.~~ Dry system pressure flow switch.
- ~~10.11.~~ Future tenant grease hood fire suppression systems.
- ~~11.12.~~ Fire pump running

B. Fire-alarm signal shall initiate various actions as indicated on the Fire Alarm Event Matrix shown on the drawings and may include the following:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Provide action message on message displays.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Activate elevator power shunt trip.
11. Record events in the system memory.
12. Record events by the system printer at the Airports Control Center.
13. Indicate device in alarm on the graphic annunciator of the Building Automation System at the Airport Control Center.
14. Control such operations as opening operable glazed panels.
15. Shut down escalators and moving walkways.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Independent fire-detection and -suppression systems.
5. User disabling of zones or individual devices.
6. Loss of communication with any panel on the network.
7. Fire-pump running.
8. Fire-pump loss of power.
9. Fire-pump power phase reversal.

- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 4. Loss of primary power at fire-alarm control unit.
 5. Ground or a single break in internal circuits of fire-alarm control unit.
 6. Abnormal ac voltage at fire-alarm control unit.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire-alarm control unit or annunciator.
 10. Voice signal amplifier failure.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.
 2. Identify specific device initiating the event at fire-alarm control unit, off-premises network control panels, and remote annunciators.
 3. Record the event on system printer at the Airport's Control Center.
 4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
 5. Transmit system status to building management system.
 6. Display system status on graphic annunciator of the Building Automation System at the Airport Control Center and Fire Command Center in the Airport Terminal.

2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 FIRE-ALARM CONTROL UNIT

- A. Provide Tyco SimplexGrinnell 4100ES Fire-Alarm Control Units only and Tyco SimplexGrinnell TrueAlarm indicating devices.
- B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

- a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
 - d. The FACP shall be listed for connection to a central-station signaling system service.
 - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class A.
 2. Pathway Survivability: Level 1.
 3. Confirm quantity of addressable devices on each signaling-line circuit with system supplier.
 4. Serial Interfaces:
 - a. One dedicated RS 485 port for remote station operation using point ID DACT.
 - b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
 - c. One USB port for PC configuration.
 - d. One dedicated port for connection to Building Automation System.
- E. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.

2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
 3. Record events by the system printer.
 4. Sound general alarm if the alarm is verified.
 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- G. Elevator Recall:
1. See Fire Alarm Event Matrix for on drawings Elevator Recall Requirements.
 2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
- H. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- K. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a module that is part of fire-alarm control unit.
1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.
 - a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.

3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- L. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- M. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- N. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 1. Batteries: Sealed lead calcium.
- O. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- P. Fire Panel Internet Interface to provide supplemental notification and remote user access to the FACU using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.
- Q. Modular Network Communications Card: To allow fire alarm panel to be tied into a campus wide network.
- R. Distributed Module Operation: FACU shall be capable of allowing remote locations of the following modules; interface of such modules shall be through a Style 7 (Class A) supervised serial communications channel (SLC):
 1. Addressable Signaling Line Circuits
 2. Initiating Device Circuits
 3. Notification Appliance Circuits
 4. Auxiliary Control Circuits
 5. Graphic Annunciator LED/Switch Control Modules
 - a. In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/command Center locations.

6. Amplifiers, voice and telephone control circuits.

2.5 FIRE ALARM TRANSPONDER PANEL (FATP)

- A. Provides same functionality as a fire alarm control unit relative to initiation and annunciation devices. Panel is configurable with amplifiers, NAC power supplies, and other accessories as necessary to provide interconnection to fire alarm devices in areas remote to the main fire alarm control unit. Fire alarm transponder panel acts as an extension to the main fire alarm control unit.

2.6 PREACTION SYSTEM

- A. Initiate Presignal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiation device connected as part of a preaction system shall be annunciated at the FACP only, without activation of the general evacuation alarm. See Fire Alarm Event Matrix on drawings for additional requirements.

2.7 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.
 3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.8 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 1. Detectors shall be two-wire type for new construction. Detector shall be two-wire or four-wire type as may be required for new and existing construction.
 2. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

4. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
5. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Multiple levels of detection sensitivity for each sensor.
 - d. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 - f. Auxiliary contact for connection to the BAS System.
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit. Fan Shutdown will be controlled by the BAS System. See Fire Alarm Event Matrix on drawings for requirements.

2.9 CARBON MONOXIDE DETECTORS

- A. General: Carbon monoxide detector listed for connection to fire-alarm system.
 - 1. Mounting: Adapter plate for outlet box mounting.
 - 2. Testable by introducing test carbon monoxide into the sensing cell.
 - 3. Detector shall provide alarm contacts and trouble contacts.
 - 4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
 - 5. Comply with UL 2075.
 - 6. Locate, mount, and wire according to manufacturer's written instructions.
 - 7. Provide means for addressable connection to fire-alarm system.
 - 8. Test button simulates an alarm condition.

2.9.2.10 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
 - 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
 - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2.10.2.11 AIR-SAMPLING SMOKE DETECTOR

- A. General Description:
 - 1. Air-sampling smoke detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.
 - 2. Provide two levels of alarm from each zone covered by the detector and two supervisory levels of alarm from each detector.
 - 3. The air being sampled shall pass through filters to remove dust particulates greater than 20 microns before entering the detection chamber.
 - 4. Detectors shall have the capability via RS 485 to connect up to 100 detectors in a network.
 - 5. Detectors shall communicate with the fire-alarm control unit via addressable, monitored dry contact closures, RS 485, and interface modules. Provide a minimum of six relays, individually programmable remotely for any function.
 - 6. Pipe airflow balancing calculations shall be performed using approved calculation software.

B. Detector:

1. Detector, Filter, Aspirator, and Relays: Housed in a mounting box and arranged in such a way that air is drawn from the detection area and a sample passed through the dual-stage filter and detector by the aspirator.
2. Obscuration Sensitivity Range: 0.005 - 6 percent obs/ft.
3. Four independent, field-programmable, smoke-alarm thresholds per sensor pipe and a programmable scan time delay. The threshold set points shall be programmable.
 - a. The four alarm thresholds may be used as follows:
 - 1) Alarm Level 1 (Alert): Activate a visual and an audible supervisory alarm.
 - 2) Alarm Level 2 (Action): Activate shutdown of electrical/HVAC equipment and activate a visual and an audible supervisory alarm.
 - 3) Alarm Level 3 (Fire 1): Activate building alarm systems and initiate call to fire response unit.
 - 4) Alarm Level 4 (Fire 2): Activate suppression system or other countermeasures.
 - b. Final Detection System Settings: Approved by Owner.
 - c. Initial Detection Alarm Settings:
 - 1) Alarm Level 1 (Alert): 0.08 percent obs/ft..
 - 2) Alarm Level 2 (Action): 1.0 percent obs/ft..
 - 3) Alarm Level 3 (Fire 1): 2.0 percent obs/ft..
 - 4) Alarm Level 4 (Fire 2): 4.0 percent obs/ft..
4. Power Supply:
 - a. Regulated 24-V dc, monitored by the fire-alarm control unit, with battery backup.
 - b. Battery backup shall provide 24 hours' standby, followed by 30 minutes at maximum connected load.
5. Detector shall also transmit the following faults:
 - a. Detector.
 - b. Airflow.
 - c. Filter.
 - d. System.
 - e. Zone.
 - f. Network.
 - g. Power.
6. Provide four in-line sample pipe inlets that shall contain a flow sensor for each pipe inlet. The detector shall be capable of identifying the pipe from which smoke was detected.
7. Aspirator: Air pump capable of allowing for multiple sampling pipe runs up to 650 feet (200 m) in total, (four pipe runs per detector) with a transport time of less than 120 seconds from the farthest sample port.
8. Air-Sampling Flow Rates Outside Manufacturer's Specified Range: Result in a trouble alarm.

9. Provide software-programmable relays rated at 2 A at 30-V dc for alarm and fault conditions.
10. Provide built-in event and smoke logging; store smoke levels, alarm conditions, operator actions, and faults with date and time of each event. Each detector (zone) shall be capable of storing up to 18,000 events.
11. Urgent and Minor Faults. Minor faults shall be designated as trouble alarms. Urgent faults, which indicate the unit may not be able to detect smoke, shall be designated as supervisory alarms.

C. Displays:

1. Include display module within each detector.
2. Each display shall provide the following features at a minimum:
 - a. A bar-graph display.
 - b. Four independent, high-intensity alarm indicators (Alert, Action, Fire 1, and Fire 2), corresponding to the four alarm thresholds of the indicated sector.
 - c. Alarm threshold indicators for Alert, Action, and Fire 1.
 - d. LED indication that the first alarm sector is established.
 - e. Detector fault and airflow fault indicators.
 - f. LED indicators shall be provided for faults originating in the particular zone (Zone Fault), faults produced by the overall smoke-detection system, and faults resulting from network wiring errors (Network Fault).
 - g. Minor and urgent LED fault indicators.

D. Sampling Tubes:

1. Smooth bore with a nominal 1-inch (25-mm) OD and a 7/8-inch (21-mm) ID. Sampling pipe with between 5/8- and 1-inch (15- and 25-mm) ID can be used in specifically approved locations when recommended by manufacturer.
2. Pipe Material: CPVC and complying with UL 1887, "Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics."
3. Joints in the sampling pipe shall be airtight. Use solvent cement approved by the pipe manufacturer on all joints except at entry to the detector.
4. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals according to NFPA 72.
5. Support pipes at not more than 60-inch (1520-mm) centers.
6. Fit end of each trunk or branch pipe with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

E. Sampling Holes:

1. Sampling holes of 5/64 inch (2 mm), or other sized holes per manufacturer's written instructions, shall be separated by not more than the maximum distance allowable for conventional smoke detectors. Intervals may vary according to calculations.
2. Follow manufacturer's written recommendations to determine the number and spacing of sampling points and the distance from sampling points to ceiling or roof structure and to forced ventilation systems.

- A. Each sampling point shall be identified by an applied decal.

2.11.2.12 NOTIFICATION APPLIANCES

- A. Provide Tyco SimplexGrinnell addressable notification appliances.
- B. General requirements for new construction for Notification Appliances: Provide individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- ~~C.D.~~ Carbon Monoxide Notification: Multi-tone device capable of providing separate and distinct sound then fire alarm horns. Provide blue lens for strobe.
- ~~D.E.~~ Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/110/185 cd, selectable in the field.
 - 2. Mounting: Wall and ceiling mounted as indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red or white as selected by the Architect.
- ~~E.F.~~ Voice/Tone Notification Appliances:
 - 1. Comply with UL 1480.
 - 2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
 - 3. High-Range Units: Rated 2 to 15 W.
 - 4. Low-Range Units: Rated 1 to 2 W.
 - 5. Mounting: Flush.
 - 6. Matching Transformers: Tap range matched to acoustical environment of speaker location.
- ~~F.G.~~ Addressable Textual Notification Appliance: Textual Notification Appliance is to operate on a compatible Signaling Line Circuit (SLC) and is to provide a high visibility, multi-color LED text message display.
 - 1. Textual Notification Appliance shall be Listed to UL 1638 Visual Signaling Appliances.

2. Appliance shall be capable of up to thirty two (32) pre-programmed message selections that can be activated in response to pre-defined emergency situations or linked to specific system point status conditions.
3. Textual Notification Appliance shall be capable of displaying dual or single line emergency instructions. Instructions can show as static, flashing, or scrolling with a variety of appearance/transition options. Instructions shall be capable of displaying using multi-colors to emphasize instructions content.
4. Textual Notification Appliance shall be capable of providing non-emergency information during non-emergency conditions. Emergency conditions will override non-emergency message/instructions and display emergency instructions.
5. Textual Notification Appliance shall be capable of scrolling instructions of at least 512 characters in length.
6. Textual Notification Appliance shall be viewable from a distance of 100 feet.
7. Textual Notification Appliance shall be powered by a listed fire alarm power supply providing 24VDC with battery back-up.
8. Textual Notification Appliance shall be capable of wall or ceiling mounting options.

2.12.13 ADDRESSABLE APPLIANCE SLC REPEATER (NAC EXTENDER)

- A. Addressable Repeater shall supervise channel (SLC) wiring and communicate with and control addressable notification appliances. The Repeater shall be a stand-alone panel capable of powering one (1) NAC SLC. The channel (SLC) shall be rated for 3 amps and support up to 127 addresses. Power and communication for the notification appliances shall be provided on the same pair of wires. It shall be possible to program the High/Low setting of the audible (horn) appliances by channel from the addressable controller.
 1. The Repeater shall provide a constant voltage output to ensure NAC current and voltage do not vary whether the panel is operating on AC or battery. The output voltage during alarm conditions shall be 29 VRMS.
 2. Addressable SLC notification appliance circuits shall be Class A, Style 6.
 3. The internal power supply and battery charger shall be capable of charging up two 12.7Ah batteries internally mounted or 25Ah batteries mounted in an external cabinet.
 4. The Repeater panel can be mounted close to the host fire alarm control unit or remotely.
 5. The Repeater status shall be communicated to the host fire alarm control unit and locally indicated.
 6. A 200mA auxiliary output shall be available.
 7. The Repeater shall be listed to UL 864.

2.13.14 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
- B. Material and Finish: Match door hardware.

2.142.15 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Flush or Surface cabinet (as indicated on the electrical drawings), NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.152.16 ADDRESSABLE INTERFACE DEVICE

- A. General:
 - 1. Include address-setting means on the module.
 - 2. Store an internal identifying code for control panel use to identify the module type.
 - 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.
 - 1. Allow the control panel to switch the relay contacts on command.
 - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
 - 1. Operate notification devices.

2.162.17 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply.
 - 5. Loss of power.
 - 6. Low battery.
 - 7. Abnormal test signal.
 - 8. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

~~2.17~~2.18 NETWORK COMMUNICATIONS

- A. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- B. Provide integration to Building Automation System for monitoring of alarm and trouble.

~~2.18~~2.19 NETWORK COMMAND GRAPHICAL WORKSTATION

- A. The Graphical Workstation (TrueSite Workstation) shall consist of:
 - 1. UL 864 Listed for Annunciation and Control and Proprietary Supervising Station use
 - 2. Industrial Grade Quad Core 2.10 GHz Rackmount Personal Computer with detachable keyboard and mouse with required operating system
 - 3. Quad Core PC and CPU Motherboard with 9 Expansion Slots (7 PCI, 1 ISA), integrated internal speakers, and Dual Video Outputs (1 SVGA, 1 DVI)
 - 4. Two 1TB Hard Drives with RAID 1, real-time mirror imaging operation and survivability on Quad Core PC. Should a failure occur on anyone hard drive, the workstation operation shall immediately transfer to the alternate mirror drive without loss of operation and a trouble shall be reported on the Graphical Workstation until the failure mode has been cleared.
 - 5. 18.5" LCD Monitor 1366 x 768 with touchscreen and built-in serial controller.
 - 6. CD/DVD Read/Write
 - 7. 4GB RAM (minimum)

8. Onboard Video for up to two displays
9. Quad Core PC with 6 available USB Ports, 1 Dedicated for Security Dongle
10. Two Ethernet Ports to support Remote Clients over Ethernet.
11. Integrated email Notification Services
12. USB Port for Graphics and Reports Printer
13. 120 VAC UPS Primary and Secondary Standby Power, UL 1481 Listed for use with the Fire Alarm Graphical Workstation
14. Pre-programmed functions
15. Field editor for graphics representation with ability to Import and Export AutoCAD graphic files
 - a. AutoCAD File Export shall support DWG/DXF file export in AutoCAD 2000 format for compatibility with any AutoCAD Version 2000 or higher programs
16. A fully functional Network Node communicating on the network. Capability to interface with up to seven (7) Network Loops on Quad Core Workstations
17. The graphical workstation shall be capable of the following operations:
 - a. Dynamic pan-and-zoom operation, systems that require multiple graphic screens for each zoom-in/zoom-out view are not acceptable
 - b. Ability to create predefined zoom levels for rapid zoom into predefined areas within a graphic screen
 - c. Ability to automatically jump to a graphic screen or a predefined zoom level within a screen for each device upon an abnormal status change
 - d. Quad Core Workstation support for Quad monitor operation with floatable/dockable windows allowing individual windows to be simultaneously displayed on up to four separate monitors.
 - 1) At minimum the graphical workstation shall be able to display;
 - a) The Main Banner with an Active List, a Graphic Screen, a Test Mode Screen, a Historical Log or System Report, or an Active Web Page (such as a webcam video display) separately on up to 4 individual monitors, or
 - b) The graphical workstation shall be able to run and display up to 4 client/server instances with each client instance displayed on individual monitors
 - e. Information displayed for Point Status, Control, Alarm Lists, Historical Logs, and Reports shall be capable of being sorted by individual categories of information; e.g., Number, Time, Date, Event, Detail, Status, etc.
 - f. Information displayed for Point Status, Control, Alarm Lists, Historical Logs, Test Mode and Reports shall be capable of being exported to XML for record keeping and report customization
 - g. 19 inch screen resolution up to 1280 x 1024.
 - h. Ability to assign operator preferences on a per operator basis. The selectable operator preferences shall be:
 - 1) Font Size: Small or Large

- 2) Toolbar Size: Small or Large
 - 3) User Interface Theme: MS Office 2003 or System Theme
 - 4) Menu Bar and Toolbar Options: Show/Hide Menu bar, Show/Hide Toolbar
- i. Graphic files shall be capable of being modified in the graphical workstation editor or exported back to AutoCAD file formats where files can be edited in AutoCAD and re-imported for system changes and upgrades
 - j. It shall be possible to import a custom site-specific system banner bitmap used to display a corporate logo or other user preferred system banner background
 - k. It shall be possible to import a custom site-specific main screen bitmap used to display a corporate logo, facility photograph and layout, or other user preferred main screen background image
 - l. The graphical workstation shall have an option for a configurable inactivity timer that automatically logs out inactive users based on a pre-defined inactivity time limit. When no user is logged in, the graphical workstation shall provide view access to system activity. Login to the system shall be required for access to additional control operations.
 - m. It shall be possible to assign a different WAV file notification signal for each abnormal event category; Fire, Priority 2, Supervisory or Trouble, that shall be played at the Server and Remote Clients.
 - n. The graphical workstation shall be capable of displaying separate Active List for Alarm, Priority 2, Supervisory, and Trouble event categories. Each Active List event category shall be capable of displaying up to 2,900 events.
- B. The Graphical Workstation shall operate by receiving system events and displaying specified graphic representations of the building(s), and system devices. Individual system events shall include a description of the building or area associated with each point in the workstation's views and reports
- C. The workstation monitor shall be touch sensitive and serve as the interactive interface between the operator and the network system. From the touch screen or mouse the operator shall be able to perform the following tasks:
1. Silence signals
 2. Acknowledge all alarm supervisory and trouble events and return to normal conditions
 3. Log operator notes associated with individual event activity
 4. Select a command link from a graphic screen to call-up an associated web-page, web-camera, or web-link. The web page command link shall be capable of being manually operated or operated automatically when the graphic screen is loaded.
 5. Reset system
 6. Display list menus
 7. Select the individual message screens
 8. Perform manual operation of system(s) control points
 9. Enable points into Test Mode to allow testing of selective devices without nuisance interruptions to the workstation operator
- a. Test Mode events shall be recorded in the background to the workstation's historical logs

- b. Test mode historical log events shall be flagged with a Test Mode Indicator for easy identification
 - 10. Request the "HELP" menu
 - 11. Perform operator login / logout
 - 12. Generate reports that can be printed or saved as an electronic textfile. Reports shall include Historical Log, Analog Device Status Report, Analog Device Service Report, AMZ Calibration Report, and Active List Report.
 - 13. Connect (Set Host) to other nodes
 - 14. Perform graphic editing functions
 - 15. Set the system time and date
- D. The unit shall be equipped with at least seven (7) levels of password-protected access.
- E. Remote Ethernet Client Support: The Graphical Workstation server shall be capable of supporting up to 20 Simultaneous Remote Client Connections over Ethernet. When the maximum simultaneous client connections have been reached a notice shall be communicated to any additional client connection attempts indicating the connection capacity limit has been reached.
- 1. Remote Clients shall be configurable for "Restricted Feature" view only or for "Protected Feature" full control operation.
 - 2. Each Remote Client shall be configurable for Supervised or Unsupervised operation. Loss of communication with a Supervised client shall be indicated at both the server and the remote supervised client. Loss of communication to an Unsupervised client shall be indicated at the remote client only.
 - 3. Remote Client operation shall be independent of the server whereas an operator at the remote client location shall be able to view graphics and text and control the system, independent of the server.
 - 4. It shall be possible to vector information to Remote Supervised Clients by selecting which points and/or event categories (Alarm, Priority 2, Supervisory, Trouble) are to be displayed at each Remote Supervised Client.
 - 5. A minimum 3 Mb/s connection speed shall be provided to Remote Clients
 - 6. Logins/Logouts at Remote Clients shall be logged in the Historical Log. Supervised Clients shall be specified by client name.
 - 7. The Graphical Workstation server shall be capable of supporting both Agency Listed Fire Alarm Ethernet LAN Applications and Supplemental Annunciation over the Customer's Ethernet LAN/WAN. Where a Fire Alarm Ethernet LAN is specified only Agency Listed Ethernet hardware shall be installed.
- F. 3rd Party Ethernet Client Support. The Graphical Workstation shall support an open protocol 3rd Party Interface solution including software development tools that allow advanced users the ability to develop an interface for the purpose of accessing data and status information directly from the Graphical Workstation. Up to 5 concurrent 3rd Party Client connections shall be supported.
- G. DACR Support. For fire alarm control units that are not network compatible or may be to remote for a network connection, the Graphical Workstation shall be capable of, and agency listed for, communication with a [Sur-Gard DACR model MLR2-DG][Sur-Gard DACR model System III][Bosch D6600][Bosch D6100i][AES Intellinet 7705i] Digital Alarm

Communicating Receiver (DACR) via an RS-232 port. Remote fire alarm panels equipped with DACTs shall communicate their local event status (or individual point status if capable) to the DACR using dial-up telephone connections and TCP/IP protocol. The DACR shall forward the individual panel status to the Graphical Workstation for information processing and history logging.

- H. DACR Events. The Graphical Workstation shall handle DACR points as though they were network points. Graphics shall be capable of being displayed on point status changes. Point status changes shall be easily acknowledged locally on the Graphical Workstation. Remote panels need to be Acknowledged, Silenced, or Reset at the panel. Point events shall be entered into the Graphical Workstation history log. The history log shall have a 500,000 event storage capacity minimum.
1. Supported DACR/DACT Formats: The Graphical Workstation DACR interface shall support standard reporting formats including: SIA, BSK, 4/2, and ADEMCO CID (Contact ID® format). A CID account shall be configurable on the Graphical Workstation to be either panel event reporting or individual point reporting. The other formats provide panel event reporting only.
 2. Public Points: The Graphical Workstation shall be capable of assigning DACR points as public points to the fire alarm network for monitoring by other network nodes if required.
 3. DACR Status Tracking by the Graphical Workstation: The DACR connection to the Graphical Workstation shall be supervised with the following trouble conditions tracked by the Graphical Workstation:
 4. Communications Loss (between DACR and Graphical Workstation)
 5. Initialization Failed (the Graphical Workstation to DACR connection did not successfully establish)
 6. Unknown DACR Message (the DACR sent a message that was not understood by the Graphical Workstation)
 7. Unknown DACR Account (the account information received does not correlate to an Graphical Workstation point)
 8. Supervision of DACTs: The Graphical Workstation shall be programmed to expect and log periodic supervisory transmissions from the DACTs via the DACR. Failure to receive a supervisory transmission shall cause a trouble event on the Graphical Workstation.
 9. Event Restoration: When the Graphical Workstation receives an event restoration from the DACR, it shall restore that point's status
 10. Custom Reports:
 - a. The operator shall be able to create up to 8 user defined historical log reports. Each custom report shall be capable of being filtered by an individual DACR account
 - b. Reports shall be capable of being exported to XML for external record retention and enhanced report customization with XML compatible programs
- I. Email Support. The graphical workstation shall have the ability to transmit email notifications when events occur on the graphical workstation.
1. Up to 50 user email accounts shall be supported.
 2. Each email user account shall be configurable to receive one or more types of events (Fire, Priority 2, Supervisory, and/or Trouble).
 3. The email content shall be selectable to include or exclude pre-defined message content allowing the size and content of the email message to be managed.

J. Graphical Workstation Operating Modes:

1. When no alarms or troubles are present, the workstation monitor shall display a graphics screen menu used to access other graphic screens. Each screen shall also display current time and date, system status, and present operator name and access level.
2. Upon activation of any alarm and on request by the operator, the workstation monitor shall display the floor plan for the device in alarm. The device in alarm shall flash until acknowledged. The device in alarm shall then become steady until cleared.
3. If a second alarm is registered prior to the first being cleared, the second shall be identified by flashing, pending alarm indication. Touching the pending alarm area shall transfer the display to the second alarm point graphic screen. All subsequent alarms shall be displayed as indicated above. Alternately, the graphical workstation shall be configurable to automatically jump to the graphic screen for the device in alarm. If the auto jump operation is selected and the point in alarm is not associated with a graphic screen, the application shall jump to the active alarm list.
4. The Graphical Workstation shall cause a "Trouble" condition on all other Network Nodes to indicate an off-line condition.
5. The Graphical Workstation shall have the capacity to annunciate 62,500 network point and/or point lists.
6. Historical event logs shall maintain up to 500,000 system events.
7. Built-in diagnostics shall provide graphical views of the network topology and status. Network communication breaks or inactive nodes shall be clearly indicated as a guide in returning the system to normal.
8. Individual point access shall display "real-time" analog sensor point information.

K. The Graphical Workstation shall have the following editing functions:

1. Message Editor - System shall have the capability of on-site adding, changing, deleting or assigning of message screens.
2. List Editor - System shall have the capability of on-site editing of customer user lists.
3. Graphics Editor - System shall have the capability of on-site editing of graphics screens. Graphics editor shall have the capability of changing background graphics and adding or deleting point symbols. Capacity to create and edit up to 25,000 Graphic Screens.

L. Operating System Compatibility:

1. The Graphical Workstation Server shall be compatible with the following operating systems:
 - a. Windows 7 Professional, 32 Bit, with Service Pack 1 or higher
 - b. Windows 7 Enterprise, 32 bit
2. Graphical Workstation Clients shall be compatible with the following operating systems:
 - a. Windows 7 Professional, 32 or 64 Bit, with Service Pack 1 or higher
 - b. Windows 7 Enterprise, 32 or 64 bit

M. Windows 7 Home Premium, 32 or 64 bit

2.192.20 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by device manufacturer.
 - 2. Finish: Paint of color to match the protected device.
 - 3. Refer to electrical drawings for locations (if any).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

- A. Do not begin installation of the Fire Alarm System until the Submittals have been approved by the Architect and Authority Having Jurisdiction.
- B. Refer to the Architectural drawings (reflected ceiling plans and interior elevations) for device locations.
- C. Comply with NFPA 72 2010 Edition and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 2011 Edition including, but not limited to, Article 760, "Fire Alarm Systems."
 - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor, except that remote annunciators shall be installed with tops of cabinets not more than 60" (1520 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
- E. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
 2. Mount manual fire-alarm box on a background of a contrasting color.
 3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- F. Smoke- or Heat-Detector Spacing:
1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
 5. HVAC: Locate detectors not closer than 60 inches ((1520 mm)) from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- G. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- H. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- I. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.
- J. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- K. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- L. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

1. Additional Audible Alarm-Indicating Devices: In addition to the devices indicated on the fire alarm drawings, provide additional devices and associated wiring as may be required for annunciation 15 dB above ambient noise conditions.
- M. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
- N. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

- A. Pathways shall be installed in EMT minimum. Comply with Section 260533 "Raceways and Boxes for Electrical Systems."
- B. All conduit, connections, fittings, and cover plates shall be red.

3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 1. Smoke dampers in air ducts of designated HVAC duct systems.
 2. Magnetically held-open doors.
 3. Electronically locked doors and access gates.
 4. Alarm-initiating connection to elevator recall system and components.
 5. Supervisory connections at valve supervisory switches.
 6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 7. Supervisory connections at elevator shunt-trip breaker.
 8. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 9. Supervisory connections at fire-pump engine control panel.

3.5 IDENTIFICATION

- A. Identify all fire alarm system components including initiation and notification devices, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260554 "Identification for Electrical Systems."

- B. Fire alarm device labeling is to be located on the base and not on removable heads where possible.
- C. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction, Architect, Airport Personnel, and others as may be required.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.
- I. Coordination with Building Automation System (BAS): Test all points monitored by the Building Automation system for functionality and correct readings at the Main Control Center. Fire Alarm Manufacturer's representative shall be on-site to coordinate all testing with BAS technician.

3.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within five years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.
 - 1. Training shall consist of a single 4 hours session.
 - 2. Training shall include hands on training including adjustment, operation, and maintenance for the equipment.
 - 3. Training shall include a question and answer session.
 - 4. Training shall be video recorded. Three electronic copies of the training (in .AVI format) shall be provided within the O&M manual submittal.

END OF SECTION 28 31 11