B C A

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# PROJECT MANUAL – VOLUME 2

FOR THE

# CAÑADA COLLEGE BUILDING 5/6 CAFETERIA RENOVATION (RFP 76)

**4200 Farm Hill Boulevard**
**Redwood City, CA 94061**

Bid Date: TBD at 2:00 pm.
Bid Number: 86638

## SAN MATEO COUNTY COMMUNITY COLLEGE DISTRICT

Cañada College

BCA Project No. 07013
DSA Approval Date: September 2011

Prepared for
San Mateo Community College District
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# USER GUIDE FOR THE PROJECT MANUAL

## 1.1 SUMMARY

A. GENERAL: This Guide is provided as a basis for understanding the organization and use of this Project Manual.

B. DESCRIPTION:

1. Construction Documents: Defined as the written and graphic documents prepared or assembled by the Architect for communicating the design of the project and administering the contract for its construction. These include the Procurement Requirements (Invitation to Bid, Instructions to Bidders, and Proposal Forms) and the Contract Documents.

2. Contract Documents: Defined as the legally enforceable requirements that become part of the contract when the agreement is signed, these include the Contract Forms, Conditions of the Contract, Specifications, Drawings, Addenda, and Contract Modifications. They describe the proposed construction (referred to as the "Work") that results from performing services, furnishing labor, and supplying and incorporating materials and equipment into the construction.

3. Contract Forms: Include the agreement, bonds and certificates.

4. Conditions of the Contract: Define the basic rights, responsibilities, and relationships of the parties involved in the construction process.

5. Specifications: Divided into 48 Divisions, the Specifications define the qualitative requirements for products, materials, and systems and the standards of workmanship required for installation. Division 1 sections constitute the GENERAL REQUIREMENTS necessary for the Project; Divisions 2 through 48 comprise the Technical Specifications portion of the Project Manual.

6. Drawings: Graphic representations of the Work, which show the materials and their relationships to one another, including sizes, shapes, fit, location, and connections.

7. Addenda: Written or graphic documents issued to clarify, revise, add to, or delete information in the original bidding documents or in previous addenda.

8. Contract Modifications: Written instruments used to add to, delete from or otherwise modify the Work after the construction agreement has been signed.

C. DIVISION 1 - GENERAL REQUIREMENTS: Division 1 of the Specifications expands on certain of the broad provisions of the Conditions of the Contract and governs the execution of all Technical Sections of the Specifications. Sections included in Division 1 specify the administrative and procedural requirements, as well as temporary facilities, required for the Project. All requirements stated in Division 1 apply to and will be in force for all subsequent Sections included in Divisions 2 through 48.

D. PRODUCT REFERENCES: Specification Section titles follow the recommendations of MASTERFORMAT 2004 edition, as published by The Construction Specifications Institute (CSI). The Section titles represent a class of product and may be stated in the singular or plural without regard to the actual quantity used on the project. The organization of product specifications by Section is not meant to define subcontracts or other divisions of work by trades.

E. MANUAL FORMAT:

1. General: The first page of each Section appears as a facing (right-hand) page and is graphically defined with boldfaced Section number and title.

2. Underlined and Boldface Type: Underlining and bolding have been used in different combinations throughout the Project Manual to highlight headings and significant text. These devices have been used to assist the user in finding items of information or to emphasize the importance of certain information. No other meaning is attached to the use of boldface and underlined text.

3. Dates: The official date of issue of the Project Manual appears on the cover sheet of this Project Manual. Dates subsequent to that date on individual Section pages indicate reissue of entire Sections for clarification.

## 1.2 DEFINITIONS AND INTERPRETATIONS

A. WORDS AND TERMS: Those which are frequently used, with special meanings, in this Project Manual are defined in Section 01 42 00 – REFERENCES.

B. GOVERNING DICTIONARY: The definitions of words used in these Specifications, which are not defined in Section 01 42 00 – REFERENCES, the General Conditions, or in referenced standards, are as given in "The American Heritage Dictionary of the English Language".

C. SPECIFICATION LANGUAGE: These Specifications are written in the imperative mood, as defined in the Construction Specifications Institute's Manual of Practice. Imperative language is directed to the Contractor. The indicative mood is employed on occasion when such sentence structure is necessary to convey the intended meaning in a more accurate or understandable form. The text is streamlined, with the colon (:) employed as a symbol for the words "shall be", "shall have", "shall conform with", "shall comply with", or "shall meet the requirements of". The colon is also used to separate a paragraph title or heading from the text that follows.

**END OF DOCUMENT**

# SECTION 01 10 00

# SUMMARY OF WORK

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes summary of Work including:
1. Work Covered By Contract Documents
2. Bid Items, Allowances, and Alternates
3. Work Under Other Contracts
4. Future Work (N/A)
5. Work Sequence
6. Business Days and Hours
7. Cooperation of Contractor and Coordination with Other Work
8. Maintenance, Product Handling, and Protection
9. Partial Occupancy/Utilization Requirements
10. Contractor Use of Premises
11. Lines and Grades
12. Protection of Existing Structures and Utilities
13. Damage to Existing Property
14. Dust Control
15. Parking
16. Laydown/Staging Area
17. Permits
18. Punch List Verification
19. Actual Damages for Violations
20. Unfavorable Construction Conditions
21. Construction Site Access
22. Specification Data Sheets and Schedules
23. Site Administration
24. Products Ordered In Advance
25. District-Furnished Products
26. CEQA Mitigations
27. Storm Water Pollution Program - *See Section 01 35 00*
28. Attic stock requirements

### 1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project is located at Cañada College, 4200 Farm Hill Blvd, Building 5/6, Redwood City, CA 94061. Work includes Building 5 Dining Room renovations, including related mechanical and electrical work, technology, security and accessibility upgrades.

B. Furnish all labor, materials, equipment, services, permits, temporary controls and construction facilities, and all general conditions, seismic requirements, general requirements and incidentals required to complete the Work in its entirety as described in the Contract Documents. The Work includes, but is not necessarily limited to the following:
1. Interior Redesign and Renovation of Cafeteria 5-320, including Career Center 5-322, Office 5-331, and Student Lounge 5-333.

C. Coordination with other contractors working at the site and their subcontractors, coordination with College and District activities, obtaining necessary permits and complying with permit and environmental conditions, project startup and testing, site restoration and cleanup.

D. The Work of this Contract comprises construction of all the Work indicated, described in the Specifications, or otherwise required by the Contract Documents.

E. Unless provided otherwise in the Contract Documents, all risk of loss to Work covered by Contract Documents shall rest with Contractor until Final Acceptance of the Work.

F. Contractor's use of the premises for Work and storage is limited to the area indicated.

G. Contractor shall be solely responsible for all utilities (including without limitation electricity, water, gas, etc.) at the Site.

H. Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified or indicated to be salvaged and reused or to remain the property of District. Contractor shall store and protect salvaged items specified or indicated to be reused in the Work.
   1. Contractor may furnish and install new items instead of those specified or indicated to be salvaged and reused, in which case such removed items will become Contractor's property.

I. Existing materials and equipment removed by Contractor shall not be reused in the Work, except where so specified or indicated.

J. Salvaged items not to be reused in the Work, but to remain District's property, shall be delivered by Contractor in good condition to District at the Facilities Maintenance Center, 4200 Farm Hill Blvd., Redwood City, CA 94063.
   1. Any items specified or indicated to be salvaged which are damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by Contractor in kind or with new items.

## 1.3 BID ITEMS, ALLOWANCES, AND ALTERNATES

A. Any Bid Item may be deleted from the Work and Contract Sum, in total or in part, prior to or after award of Contract without compensation in any form or adjustment of other Bid Items or prices therefore.

B. Payment of all items is subject to provisions of Contract Documents, including without limitation Section 01 29 00 (Measurement and Payment).

C. For all Bid Items, furnish and install all work indicated and described in Specifications and all other Contract Documents, including connections to existing systems. Work and requirements applicable to each individual Bid Item, or unit of Work, shall be deemed incorporated into the description of each Bid Item..

D. Descriptions of Lump Sum Items (listed by Bid Item Numbers). Bid items are not intended to be exclusive descriptions of work categories and Bidder shall determine and include in its pricing all materials, labor, and equipment necessary to complete each Bid Item as shown and specified:
   1. Bonds and Insurance: The lump sum price paid under this item shall be full payment for all Bonds and Insurance required by Document 00 71 00 (General Conditions).
   2. Safety Plan and Programs: The lump sum price paid under this item shall be full payment for providing the Safety Plan and programs as required by Section 01 56 00 (Site Security and Safety) and 00 71 00 (General Conditions).
   3. Mobilization/Demobilization: The lump sum price paid under this item shall be full payment for initial mobilization at Project commencement (50% to be paid then), and cleanup and demobilization at Final Completion of Work to be completed (50% to be paid then).

4. Installation, Operation, and Maintenance Manuals, Record Drawings: The lump sum price paid under this item shall be full payment for preparation of installation, operation, and maintenance manuals.
5. All Work of Contract Documents other than Work separately provided for under other Bid Items. The lump sum price paid under this item shall be full payment for all Work of Contract Documents other than Work separately provided for under other Bid Items, including cleaning, startup, and testing, submittals, and all other general conditions, general requirements, and seismic requirements.

E. Allowances:
1. Allowance work shall be done as Change Orders and as specified in Section 01 26 00 (Modification Procedures). Identify Allowance Items (See Document 00 41 00 "Bid Form") work on the Progress Schedules and on Applications for Payment.
2. The Amount given on Document 00 41 00 (Bid Form) under each Allowance Item is the sum of money set aside for each Allowance Item. These amounts shall be included in the Contract Sum on the Bid Form.
3. If the cost of work done under any Allowance Item is less than the amount given on the Bid Form under that Allowance Item, the Contract Sum shall be reduced by the difference between the amount given in the Bid Form and the cost of work actually done.
4. Scope of Allowances: See Section 01 21 00.

F. Alternates: See Section 01 23 00.

## 1.4 WORK UNDER OTHER CONTRACTS

A. Work at the site performed by others includes the following:
1. Hazardous Materials Abatement, prior to turning the building over to the contractor.
2. Cañada Vista Housing Project.

## 1.5 FUTURE WORK

A. Future work at the site to be performed by others includes the following:
1. Cañada College 12 kV Electrical Upgrade Project

## 1.5 WORK SEQUENCE

A. Construct Work in stages and at times to accommodate District operation requirements during the construction period; coordinate construction schedule and operations with District.

B. Contractor shall not have access to the buildings prior to Hazardous Materials Abatement, unless otherwise agreed upon by District. Contractor shall schedule Work in this area accordingly.

C. Contractor acknowledges that shoring may be required to maintain a safe excavation and protect facilities, including both existing and recently constructed under this Contract. All expenses for shoring of excavations shall be included in the appropriate bid items.

## 1.6 BUSINESS DAYS AND HOURS

A. The District's Regular Business Days and hours for construction personnel, such as facilities managers, architects, inspectors, and maintenance personnel, are Monday-Friday inclusive, 7:30 a.m. - 4:30 p.m. local time.

B. Contractor is advised that District, students and faculty are on campuses Monday – Friday, 8:00 a.m. - 10:00 p.m., with generally less activity between 1:00 p.m. and 6:00 p.m., and Saturday 8:00 a.m. – 1:00 p.m.

C. Contractor may work at the Site on weekends or holidays if it notifies District in writing at least 48 hours in advance. In the case of Work by Contractor after normal working hours or on weekends or holidays, Contractor shall be responsible for any additional inspection costs incurred by the District. Such costs may be withheld from any succeeding monthly progress payment.

D. See Section 00 73 00 Supplementary Conditions for College Activities and Events which may also result in Contractor's inability to work.

E. Contractor shall protect facilities against deleterious substances and damage.

## 1.7 COOPERATION OF CONTRACTOR AND COORDINATION WITH OTHER WORK

A. Coordinate with District and any District forces, or other contractors and forces, as required by Document 00 71 00 (General Conditions), paragraph 6.

B. Contractor shall coordinate the construction schedule with the regular daily operations schedule of the District and Campus for minimal interruption during utility service installations/modifications. All shut-downs required to perform the work and temporary facilities/utilities to affected District constituencies or other projects shall be coordinated by the Contractor and included in the base scope/cost of the project for normal power service installation.

C. Noise: Construction activities are to comply with applicable local noise ordinance and applicable Cal-OSHA regulations.

D. Connections to Existing Facilities. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, Contractor shall receive permission from District or the owning utility prior to undertaking connections.

## 1.8 MAINTENANCE, PRODUCT HANDLING, AND PROTECTION

A. Transport, deliver, handle, and store materials and equipment at the Site in such a manner as to prevent the breakage, damage or intrusions of foreign matter or moisture, and otherwise to prevent damage.

B. Hazardous substance compliance: Provide District with copies of the OSHA Material Safety Data Sheets (MSDS) for all products containing a hazardous substance, examples: Adhesives, paints, sealants, and the like.

C. Packaging: Provide packaged material in manufacturer's original containers with seals unbroken and labels intact until incorporated into the Work.

D. Remove all damaged or otherwise unsuitable material and equipment promptly from the Site.

E. Protection: Protect all finished surfaces.

F. Asbestos Removal: If, during the progress of the Work, suspected asbestos-containing products are identified, Contractor shall stop work in the affected area and immediately notify the Owner. Owner shall either directly engage an asbestos removal contractor to verify the materials and, if necessary, encapsulate, enclose, or remove and dispose of all

asbestos in accordance with current regulations of the Environmental Protection Agency and the U. S. Department of Labor – Occupational Safety and Health Administration, the state asbestos regulating agency, and any local government agency; or Owner shall direct Contractor to do the same as a Change Order to the contract. The Contractor shall take all measures to avoid and/or mitigate delays due to Hazardous Materials/Waste finds such as: avoiding the area of the find and proceeding with other work on the project; developing "work around" plans; and documenting his best efforts to avoid and/or mitigate delays.

1. Asbestos Removal Subcontractor's Qualifications. The Subcontractor for asbestos removal shall be regularly engaged in this type of activity and shall be familiar with the regulations that govern this work. The Subcontractor shall demonstrate to the satisfaction of District that it has successfully completed at least three asbestos removal projects that it has the necessary staff and equipment to perform the work, and that it has an approved site for disposal of the asbestos. Liability insurance covering the asbestos abatement work shall be provided as specified in the Supplementary Conditions.
2. Asbestos Removal Methods. The asbestos removal Subcontractor shall submit a work plan of its proposed removal procedure to District before beginning work and shall certify that the methods are in full compliance with the governing regulations. The work plan shall cover all aspects of the removal, including health and safety of employees and building occupants, hygiene facilities, employee certification, clearance criteria, transportation and disposal, enclosure techniques, and other techniques appropriate for the proposed work.

G. Cost of maintenance of systems and equipment prior to either Substantial Completion or filing of a Notice of Completion will be considered as included in prices bid and no direct or additional payment will be made therefore.

H. Contractor is to complete, and if necessary develop, maintenance logs for each piece of major equipment installed and/or stored until project close out. This equipment includes:
1) New HVAC equipment.

I. Maintenance logs, Operation and Maintenance Manuals and all related contract close-out documentation will be submitted to the District's Representative no more than thirty (30) days after the date of Substantial Completion. A Notice of Completion will not be filed until all contract close-out documents are submitted and approved.

## 1.9 PARTIAL OCCUPANCY/UTILIZATION REQUIREMENTS

A. Allow District to take possession of and use any completed or partially completed portion of the Work during the progress of the Work as soon as is possible without interference to the Work.

B. Possession, use of Work, and placement and installation of equipment by District shall not in any way evidence the completion of the Work or any part of it.

C. Contractor shall not be held responsible for damage to the occupied part of the Work resulting from District occupancy.

D. Make available, in areas occupied, on a 24-hour per day and 7-day per week basis if required, any utility services, heating, and cooling in condition to be put in operation at the time of occupancy.

1. Responsibility for operation and maintenance of said equipment shall remain with Contractor.
2. Make, and District shall certify, an itemized list of each piece of equipment so operated with the date operation commences.
3. Itemized list noted above shall be basis for commencement of warranty period for equipment.

4. District shall pay for utility cost arising out of occupancy by District during construction.

E. Use and occupancy by District prior to acceptance of Work does not relieve Contractor of its responsibility to maintain insurance and bonds required under the Contract until entire Work is completed and accepted by District.

F. Prior to date of Final Acceptance of the Work by District, all necessary repairs or renewals in Work or part thereof so used, not due to ordinary wear and tear, but due to defective materials or workmanship or to operations of Contractor, shall be made at expense of Contractor, as required in Document 00 71 00 (General Conditions).

G. Use by District of Work or part thereof as contemplated by this Section 01 10 00 shall in no case be construed as constituting acceptance of Work or any part thereof. Such use shall neither relieve Contractor of any responsibilities under Contract, nor act as waiver by District of any of the conditions thereof.

H. District may specify in the Contract Documents that portions of the Work, including electrical and mechanical systems or separate structures, shall be substantially completed on dates described in paragraph 08 of this Section 01 10 00, if any, prior to substantial completion of all of the Work. Contractor shall notify District's Representative and Architect/Engineer in writing when Contractor considers any such part of the Work ready for its intended use and substantially complete and request District to issue a Certificate of Substantial Completion for that part of the Work.

## 1.10 CONTRACTOR USE OF PREMISES

A. Confine operations at Site to areas permitted by Contract Documents, permits, ordinances, and laws.

B. Do not unreasonably encumber Project Site with materials or equipment.

C. Assume full responsibility for protection and safekeeping of products stored on premises.

D. Move any stored products that interfere with operations of District or other contractor.

E. Parking, storage, staging, and work areas shall be coordinated with the District, and comply with all other Contract documents requirements.

## 1.11 LINES AND GRADES

A. All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

B. District shall provide basic horizontal and vertical control points to be used as datums for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as a part of the Work.

C. Contractor shall provide at its cost an experienced instrument person, competent assistants, and such instruments, tools, stakes and other materials required to complete the survey, layout, and measurement work. In addition, Contractor shall furnish at its cost competent persons and such tools, stakes, and other materials as District (and/or any Architect/Engineer) may require in establishing or designating control points, or in checking survey, layout, and measurement work performed by Contractor.

D. Contractor shall keep District informed, a reasonable time in advance, of the times and places at which it wishes to do survey/layout work, so that any checking deemed

necessary by District may be done with minimum inconvenience to District and minimum delay to Contractor.

E. Contractor shall remove and reconstruct Work which is improperly located.

## 1.12 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings may indicate existing above- and below-grade structures, drainage lines, storm drains, sewers, water, gas, electrical, hot water, and other similar items and utilities that are known to District.

B. Contractor shall locate these known existing installations before proceeding with trenching or other operations which may cause damage, shall maintain them in service where appropriate, and shall repair any damage to them caused by the Work, at no increase in Contract Sum.

C. Additional utilities whose locations are unknown to District are suspected to exist. Contractor must be alert to their existence. If additional utilities are encountered, Contractor must immediately report to District for disposition.

D. In addition to reporting, if a utility is damaged, Contractor must take appropriate action as provided in Document 00 71 00 (General Conditions).

E. Additional compensation or extension of time on account of utilities not indicated or otherwise brought to Contractor's attention including reasonable action taken to protect or repair damage shall be determined as provided in Document 00 71 00 (General Conditions).

## 1.13 DAMAGE TO EXISTING PROPERTY

A. Contractor will be responsible for any damage to existing structures, Work, materials, or equipment because of its operations and shall repair or replace any damaged structures, Work, materials, or equipment to the satisfaction of, and at no additional cost to, District.

B. Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.

C. Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or workers to or from the Work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

## 1.14 DUST CONTROL

A. Contractor shall take reasonable measures to prevent unnecessary dust. The following items shall be specifically implemented to control dust:
   1. All construction locations with active excavation shall be watered at least twice daily.
   2. Cover all trucks hauling soil, sand, and other loose materials; or require all trucks to maintain at least two feet of freeboard.
   3. Pave, apply water daily, or apply non-toxic soil stabilizers on all un-paved access roads, parking areas, and staging areas at construction site.
   4. Sweep daily with water sweepers all paved access roads, parking areas, and staging areas at construction sites during earthwork activities.
   5. Enclose, cover, water twice daily, or apply non-toxic soil binders to exposed stockpiles (dirt, sand, etc.)
   6. Limit the speed of all construction vehicles to 5 miles per hour while on un-paved roads at the Site.

B. Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing and new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

C. Building Interiors: provide dust barriers, walk-off pads, etc. to minimize dust infiltration in buildings. If required, the Contractor will clean interior common areas (e.g., corridors, lobbies) as needed during each work day.

## 1.15 PARKING

A. Parking will be provided in designated areas at no cost to the Contractor.

## 1.16 LAYDOWN/STAGING AREA

A. Contractor shall utilize the area indicated on the Drawings for storage of all construction materials. This area shall be fenced and locked by Contractor for security purposes.

## 1.17 PUNCH LIST VERIFICATION

A. A punch list examination will be performed upon Substantial Completion of Work. One follow-up review of punch list items for each discipline will be provided. If further Site visits are required to review punch list items due to incompleteness of the Work by Contractor, at District's discretion, Contractor shall reimburse District for these visits.

## 1.18 UNFAVORABLE CONSTRUCTION CONDITIONS

A. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to Work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner. The Contractor will employ BEST practices to manage the construction site during inclement weather.

## 1.19 CONSTRUCTION SITE ACCESS

A. Contractor shall at all times limit access to the Site to necessary personnel only. All personnel associated with construction of the Project shall enter the site through Contractor's access gate, at the location indicated on the Drawings. Access for construction personnel shall be limited to regular work hours, unless prior approval is obtained from the District. All mail and deliveries (Federal Express, equipment, etc.) shall be sent to a separate address (at Contractor's gate), specifically arranged by Contractor for the Project. Contractor is responsible for providing adequate signage (subject to District approval) to alert delivery persons to the project site. The District will not receive or forward Contractor mail or deliveries.

## 1.20 SPECIFICATION DATA SHEETS AND SCHEDULES

A. Specifications may have data sheets and schedules as part of specific specification sections. Locations for data entries on the data sheets and schedules may be left blank intentionally. Each line where data may be entered on the data sheet has a selection box in the column "Chk". When the box for a line is checked and no data is entered in the respective line, this indicates that no data is required for that line of the data sheet.

B. Other standard codes which apply to the Work are designated in the Specifications.

## 1.21 SITE ADMINISTRATION

A. Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to

District or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site to observe the same regulations as Contractor requires of its employees.

## 1.23 EROSION CONTROL

A. Scope of Work:
1. General: Provide all materials, equipment and labor necessary to furnish and install straw wattles, silt fence barriers, hydroseed, or other Best Management Practices (BMP's) at locations shown on the Contractors Storm Water Pollution Prevention Plan. *See Section 01 35 00 for further detail.*
2. Storm Water Pollution Prevention Plan: Prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) tailored to the Contractor's operations, methods and equipment. Comply with State Water Resources Control Board requirements. The SWPPP shall be reviewed and approved by the authority having jurisdiction prior to the start of work. The SWPPP shall be tailored to the contractor's approach to the work in this contract. The Contractor shall as a minimum address:
   a. Cut and fill operations
   b. Temporary stockpiles
   c. Vehicle and equipment storage, maintenance and fueling operations
   d. Concrete, plaster, mortar and paint disposal
   e. Dust control
   f. Tracking of dirt and mud, on and off of site, and adjacent streets.
   g. Pipe flushing and protection of drainage facilities both new and existing, on and off site as required by State Water Resources Control Board.

B. Quality Assurance:
1. General: Comply with governing codes and regulations of the State Water Resources Control Board.

C. Submittals:
1. Notice Of Intent (NOI): The Contractor shall submit a NOI to the State Water Resources Control Board in the name of San Mateo County Community College District prior to beginning work on site if required.

# PART 2 - PRODUCTS

## 2.1 PRODUCTS ORDERED IN ADVANCE (Not applicable)

## 2.2 RESPONSIBILITIES FOR DISTRICT - FURNISHED PRODUCTS

A. District's Responsibilities:
1. Arrange for and deliver District-reviewed Shop Drawings, Product Data, and Samples, to Contractor.
2. Arrange and pay for delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
1. Review District-reviewed Shop Drawings, Product Data, and Samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with District.
3. Handle, store, install, and finish products.
4. Repair or replace items damaged after receipt.

5. Install into Project per Contract Documents.

C. Products furnished to site and installed by Owner:
1. Refrigerator.
2. Designated casework and duplication equipment.
3. Designated microwave appliances at Cafeteria 5-320.

C. Products furnished to site and installed by Contractor:
1. NEC 2x2 LCD TileMatrix™ Video Wall Solution at Cafeteria 5-320.
2. Stage Lighting at Cafeteria 5-320.

## 2.3 SUMMARY OF REQUIRED ATTIC STOCK

The following is a list of the attic stock items that the Contractor shall furnish as part of the project and turn over to campus Facilities staff at project completion. This list supersedes attic stock required in Divisions 2 through 32. Additionally, in many cases, the list below requires attic stock in sections where the Specifications are silent about the need for attic stock. If any Specification section requests attic stock and that section is not listed below, the contractor shall provide the extra material as noted in that section.

06 41 00 Custom Cabinets: Reference paragraph 2.2. Contractor to provide six (6) spare of each type and size of pull, hinge, drawer slide, locks, catches, shelf supports, silencers, coat hooks, metal label holders.

08 71 00 Door Hardware: Contractor to provide 5% of closers, hinges, locksets, panic bars for each door type. In addition, Contractor to provide one (1) automatic door operator and one (1) replacement set of handicap door operator push button assemblies.

09 51 13 Acoustical Panel Ceilings: Supersede paragraph 1.11.B.1; Contractor to provide twenty (20) cartons of acoustical panels.

09 65 00 Resilient Flooring: Supersede paragraph 1.14.B.1; Contractor to provide 100 lineal feet of base and 100 square feet of each type and color of flooring.

09 68 16 Sheet Carpeting: Supersede paragraph 1.9.A.; Contractor to provide 10% of each pattern furnished.

21 00 00 Basic Fire Suppression Requirements: Contractor to provide twelve (12) spares of each type of fire sprinkler heads and trim rings used.

27 53 13 Central Clock System: Contractor to provide five (5) spare clocks.

28 31 00 Fire Detection and Alarm System: Contractor to provide 5% extra of smoke detectors, duct detectors, horns, strobe lights, combination horn/strobes, tamper switches, flow switches and manual pull stations used in the project. In addition, Contractor to provide one (1) spare RCC board and six (6) spare magnetic door hold opens.

## PART 3 - EXECUTION – NOT USED

**END OF SECTION**

# SECTION 01 23 00

# ALTERNATES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes administrative and procedural requirements governing Alternates. Each Alternate is identified by number and describes the basic changes to be made in the Work.

B. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bid Documents that the Owner may elect to add to or deduct from the Base Bid amount, if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents. The cost for each alternate is the net addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

C. Documentation of changes to contract Sum/Price.

D. Related Sections:
1. Document 00 11 19 - Instructions to Bidders: Determination of lowest responsive and responsible bid.
2. Document 00 41 00 - Bid Form: Indicating monetary value of Alternates.
3. Document 00 52 00 - Agreement: Incorporating monetary value of accepted Alternates.
4. Section 01 32 19 - Submittals: Work affected by Alternates.
5. Section 01 60 00 – Product Requirements: Product options and substitutions.

### 1.2 SUBMISSION REQUIREMENTS

A. Submit Alternates identifying the affect on adjacent or related components.

B. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option any time during the construction contract.

C. Coordinate related work and modify surrounding work to integrate the work of each Alternate.

### 1.3 SELECTION AND AWARD OF ALTERNATES

A. Indicate price for Alternates described below and listed in the Document 00 41 00 (Bid Form). This form requests a "difference" in Bid Price by adding to the base Bid Price.

B. Bids will be evaluated on the base bid price and price of Alternates.

C. Execute accepted alternates under the same conditions as other Work of this Contract.

D. Base Bid work described under each Alternate involves base bid work if the alternate bid is not accepted.

E. A "Schedule of Alternates" is included with this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

## 1.4 SCHEDULE OF ALTERNATES

A. Add Alternate No. 1 – Not Used.

B. Add Alternate No. 2 – Not Used.

C. Add Alternate No. 3 – Not Used.

D. Add Alternate No. 4 – Not Used.

E. Add Alternate No. 5 – Not Used.

F. RFP 76, Add Alternate No. 6 – Wood Slat Ceiling at (E) high bay ceiling coffers.
1. Provide wood slat ceiling at (e) high bay ceiling coffers at Cafeteria 5-320.
2. Rework (e) fire sprinklers at coffers to accommodate suspended wood slat ceiling.
3. Provide pendant mounted light fixtures with "linen look" finish, at (e) high bay ceiling coffers.
4. All as shown on RFP 76, Drawing A0.1, A3.34, A6.5, A8.6, and A10.93, and as specified in Section 09 51 00 – Acoustical Panel Ceilings.
5. Base Bid:
   a. Existing 1' x 1' adhesive-applied acoustical ceiling tile to remain at High Ceiling Coffers.
   b. Remove (e) "X" light fixtures.
   c. Provide Surface-mounted light fixtures.
   d. Provide linen fabric coated with vinyl wipe down finish on light fixtures.

G. RFP 76, Add Alternate No. 7 – Fire-Rated Storefront System.
1. Provide fire-rated steel-framed Storefront system between Cafeteria 5-320 and Corridor 5-301N on grid line 14 between Grids Q-R, R-S, U-V, and V-W.
2. Replace (e) wood doors A320, A320A, and A320B with fire-rated storefront doors and sidelights.
3. All as shown on RFP 76, Drawing A0.1, A2.3, A6.4, A8.5, A9.2, A10.93; and as specified in Sections 08 41 23 – Fire Rated Glass and Framing Systems.
4. Base Bid:
   a. The three middle bays on grid line 14 (between Grid R-S, S-T, and T-U) to remain as (e) finished wall. The (e) wood doors at Door 5-320, 5-320A, and 5-320B to remain.

H. RFP 76, Add Alternate No. 8 – Circular Soffit Opening and Designated Portion of Angled Soffit at East Wall of Cafeteria 5-320 (between Grid 17 and Grid 19).
1. Provide circular soffit opening, and designated portion of angled soffit at east wall of Cafeteria 5-320.
2. All as shown on RFP 76, Drawings A3.33, A6.5, A8.6, A10.94, M2.3d, and E2.3.
3. Base Bid: Base Bid shall not include circular soffit opening and designated portion of angled soffit (south of Grid Line 17) at East Wall of Cafeteria 5-320. Base Bid shall include only that portion of the angled soffit shown on A3.32.

I. RFP 76, Add Alternate No. 9 – Surface-Mounted Plastic-Laminate-Covered MDF Panel Ceiling at High Ceiling Coffers.
1. Provide surface-mounted plastic-laminate-covered MDF panel ceiling at high ceiling coffers.
2. All as shown on RFP 76, Drawings A3.34, A10.94, and as specified in Section 06 20 00.
3. Base Bid: Existing 1' x 1' adhesive-applied acoustical ceiling tile to remain at High Ceiling Coffers.

J. RFP 76, Add Alternate No. 10 – Remote Lowering System for Stage Lighting.
   1. Provide remote lowering system for Stage Lighting.
   2. All as shown on RFP 76, Drawing A0.1, A2.6, A3.34, A8.6, A10.93, E3.3; and as specified in Section 11 61 00 – Stage Equipment.
   3. Base Bid: Base Bid does not include remote lowering system for stage lighting.

K. RFP 76, Add Alternate No. 11 – Student Lounge Storefront System, Doors, and Column Surrounds, Interior Finishes, and Soffit above (between Grid 19 and Grid 20).
   1. Provide student lounge storefront system; doors; column surrounds; interior finishes; and soffit.
   2. All as shown on RFP 76, Drawing A0.1, A2.6, A3.33, A8.5, A9.1, A9.2, A9.40, A9.44, A10.93, M2.3d, E2.3, E3.3, T4.3, FA3.3, FA4.1; and as specified in primary Sections:
      a. Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.
      b. Section 09 21 16 – Gypsum Board Assemblies.
      c. Section 09 22 16 – Non-Structural Metal Framing.
      d. Section 09 68 16 - Sheet Carpeting.
   3. Base Bid: Base Bid does not include storefront system, doors, or column surrounds for the Student Lounge area. Base Bid construction for this area as shown on Drawings A2.3, A3.32, and A9.43.

## PART 2 – PRODUCTS

Not Used.

## PART 3 - EXECUTION

Not Used.

**END OF SECTION**

# SECTION 02 41 19

# SELECTIVE STRUCTURE DEMOLITION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Demolishing designated building equipment and fixtures.
2. Demolishing designated construction.
3. Cutting and alterations for completion of the Work.
4. Removing designated items for Owner's retention.
5. Protecting items designated to remain.
6. Removing demolished materials.

B. Work Specified But Not Performed Under This Section:
1. Demolition work designated to be performed by District's abatement contractor under Section 01 10 00 is listed within Section 02 41 19.

C. Related Sections:
1. Section 01 10 00 – Summary of Work: Work under separate contracts.

### 1.2 SUBMITTALS

A. Section 01 32 19 - Submittal Procedures: Requirements for submittals.

B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

C. Shop Drawings:
1. Indicate demolition and removal sequence.
2. Indicate location of items designated for Owner's retention.
3. Indicate location and construction of temporary work.

### 1.3 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Contract Closeout: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

### 1.4 QUALITY ASSURANCE

A. Conform to applicable local code for demolition work, dust control, and products requiring electrical disconnection and re-connection.

B. Conform to applicable local code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

## 1.5 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

## 1.6 SCHEDULING

A. Section 01 32 16 - Progress Schedules and Report: Requirements for scheduling.

B. Schedule Work to coincide with new construction.

C. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation and occupancy in adjoining spaces.

D. Perform noisy, malodorous, or dusty, or work:
   1. Between hours as designated by Owner's representative. [ to be determined ].

E. Coordinate utility and building service interruptions with Owner.
   1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
   2. Schedule tie-ins to existing systems to minimize disruption.
   3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

## 1.7 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

# PART 2 - PRODUCTS

Not Used.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.

D. Layout cuts in post tensioned concrete elements to avoid cutting concrete within 12 inches of any stressing tendon. Notify Architect/Engineer three days in advance of cutting post-tensioned concrete.

E. Erect and maintain weatherproof closures for exterior openings.

F. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy of adjacent Building 8.

G. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

H. Provide appropriate temporary signage including signage for exit or building egress.

I. Do not close or obstruct building egress path.

J. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

## 3.2 SALVAGE REQUIREMENTS

A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.

B. Tag components and equipment Owner designates for salvage.

C. Protect designated salvage items from demolition operations until items can be removed.

D. Carefully remove building components and equipment indicated to be salvaged.

E. Disassemble as required to permit removal from building.

F. Package small and loose parts to avoid loss.

G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.

H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.

I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

## 3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Maintain protected egress from and access to adjacent existing buildings at all times.

C. Do not close or obstruct roadways or sidewalks without permits.

D. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer.

E. Disconnect and remove designated utilities within demolition areas.

F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

G. Demolish in orderly and careful manner. Protect existing improvements, supporting structural members and built-in items designated to remain.

H. Carefully remove building components indicated to be reused.
1. Disassemble components as required to permit removal.
2. Package small and loose parts to avoid loss.
3. Mark components and packaged parts to permit reinstallation.
4. Store components, protected from construction operations, until reinstalled.

I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

K. Remove temporary Work.

## 3.4 SCHEDULES

A. Remove, store and protect the following materials and equipment for reinstallation in the project:
1. Designated (e) doors and door hardware.
2. Designated (e) "hands free" sinks.
3. Designated (e) umbrella tables bolted to Third Floor Terrace, for relocation to upper patio.

B. Remove the following equipment and salvage for Owner's retention. Deliver to location designated by Owner's Representative:
1. Designated (e) telecom/IT equipment.
2. Designated (e) office partitions.
3. Designated (e) "hands free" battery operated paper towel dispensers.
4. Designated (e) wall mounted hand sanitizer dispenser and medical scope holders.
5. Designated (e) wall mounted accessories and devices.

C. Protect the following materials and equipment remaining:
1. Designated (e) partitions to remain.
2. Designated (e) elevator motor to remain.
3. Designated (e) fire hose cabinets to remain.
4. Designated (e) exposed structure to remain.
5. Designated (e) ceiling and light fixtures to remain.

D. Demolish the following materials and equipment:
1. Designated (e) storefront assembly.
2. Designated (e) storefront assembly (by District's abatement contractor).
3. Designated (e) wood bench seats.
4. Designated (e) casework.
5. Designated (e) restroom finishes.
6. Designated (e) plumbing fixtures.
7. Designated (e) stud-wall partitions.
8. Designated (e) toilet accessories.
9. Designated (e) stair nosings at concrete treads.
10. Designated (e) rubber mat and associated automatic door opener equipment.
11. Designated (e) asphalt paving and wood spacers.
12. Designated (e) firehouse cabinet.
13. Designated (e) sinks.
14. Designated (e) elevator, guiderails, and equipment.
15. Designated (e) elevator motor.
16. Designated (e) windows and frames.
17. Designated (e) doors and frames.

18. Designated (e) floor finishes.
19. Designated (e) floor finishes (by District's abatement contractor).
20. Designated (e) exterior TV antenna and wiremold.
21. Designated (e) partitions.
22. Designated (e) interior doors, door frames, and hardware.
23. Designated (e) concrete stairs and metal railings.
24. Designated (e) concrete retaining wall.
25. Designated (e) concrete seat wall.
26. Designated (e) drinking fountains.
27. Designated (e) deck drain and leader.
28. Designated (e) 12x12 acoustical ceiling tile system.
29. Designated (e) recessed light fixtures.
30. Designated (e) ceiling registers.
31. Designated (e) surface mounted acoustical tiles and light fixtures.
32. Designated (e) suspended acoustical panel ceiling system, including recessed and surface mounted light fixtures and registers.
33. Designated (e) lath and plaster ceiling, including recessed and surface mounted light fixtures and registers.
34. Designated (e) suspended light fixtures.
35. Designated (e) ceiling mounted privacy curtain and track.
36. Designated (e) gypsum board ceiling and ceiling mounted light fixtures.
37. Designated (e) ceiling finishes.
38. Designated (e) ceiling finishes and light fixtures (by District's abatement contractor).

**END OF SECTION**

# SECTION 05 12 00

# STRUCTURAL STEEL FRAMING

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. Section Includes: Provision of structural steel as indicated on the Contract Drawings. Work includes but is not necessarily limited to the following:
   1. Structural steel framing, including all structural steel shown on the structural drawings and all standard shapes, plates and rods shown on the Architectural, Mechanical and Electrical drawings that connect to the building structure.
   2. Welded stud connectors for composite construction, concrete engagement, and attachment of building components.
   3. Anchor rods.
   4. Shop painting.

### 1.2 REFERENCES

A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.

B. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
   1. California Code of Regulations, Title 24, Part 2, also known as the California Building Code (CBC), 2007 Edition.

   2. ASTM International:
      a. ASTM A6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
      b. ASTM A36 –Standard Specification for Carbon Structural Steel.
      c. ASTM A108 – ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
      d. ASTM A153 - ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      e. ASTM A307 - ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
      f. ASTM A325 – ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
      g. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
      h. ASMM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
      i. ASTM B695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
      j. ASTM C1035 – Standard Specification for Lead and Cadmium Extracted from Glazed Ceramic Cookware.
      k. ASTM F436 - Standard Specification for Hardened Steel Washers.
      l. ASTM F844 – Standard Specification for Washers, Steel, Plain (Flat) Unbonded for General Use.
      m. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
      n. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

o. ASTM F1852 – Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

3. American Institute of Steel Construction:
   a. ANSI/AISC 360-05 - Specification for Structural Steel Buildings. (AISC1).
   b. AISC 303-05 - Code of Standard Practice for Steel Buildings and Bridges. (AISC2).
      1) No provision of AISC2 shall be effective to change the duties and responsibilities of the Owner, Contractor or Structural Engineer from those set forth in these Contract Documents.
      2) Where discrepancies exist between the requirements of the Contract Documents and AISC2, the requirements of the Contract Documents shall govern.
   c. ANSI/AISC 341-05 - Seismic Provisions for Structural Steel Buildings. (AISC3).

4. American Welding Society:
   a. AWS A5 - Filler Metal Specifications.
   b. AWS C4.1 -
   c. AWS D1.1 - Structural Welding Code – Steel.
   d. AWS 2.4 - Standard Symbols for Welding, Brazing and Nondestructive Examination.
   e. AWS QC1 - Standard for AWS Certification of Welding Inspectors.

5. SSPC – The Society for Protective Coatings:
   a. SSPC – Steel Structures Painting Manual.
   b. SSPC SP 1 - Solvent Cleaning.
   c. SSPC SP 2 - Hand Tool Cleaning.
   d. SSPC SP 7 - Brush-Off Blast Cleaning.

6. Research Council on Structural Connections:
   a. RCSC - Specifications for Structural Joints using ASTM A325 or A490 Bolts.

7. American Society of Non-Destructive Testing:
   a. ANSI/ASNT CP-189-2006 - Standard for Qualification and Certification of Nondestructive Testing Personnel.
   b. ASNT Recommended Practice No. SNT-TC-1A - Personnel Qualification and Certification in Nondestructive Testing, 200.

8. Federal Emergency Management Association:
   1. FEMA-353 - Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications.

9. American Iron and Steel Institute (AISI).

## 1.3 DEFINITIONS

A. AESS – Architecturally Exposed Structural Steel. Items designated "AESS" on the drawings are subject to special requirements in this provision.

B. Demand-Critical Welds: Demand-Critical Welds are designated on the structural drawings. All Demand-Critical Welds are part of the Seismic-Load-Resisting System.

C. Extra Smooth: Surfaces noted herein as "Extra Smooth" require a finish with surface variation of 500 micro-inches or less (AWS C4.1-77, Sample #4).

D. Gouge: Any depression deeper than the overall surface roughness.

E. Nondestructive Testing: Nondestructive testing (NDT) includes magnetic particle testing (MT), penetrant testing (PT), radiographic testing (RT), and ultrasonic testing (UT).The terms nondestructive examination (NDE) and nondestructive testing (NDT) are synonymous.

F. Protected Zone: The Protected Zone is defined as structural members, or portions thereof, to which connections of structural and non-structural elements are limited. The Protected Zone is designated on the structural drawings.

G. Quality Assurance Plan: The Quality Assurance Plan is set of the written requirements containing the set of procedures that are to be followed by the Owner's Testing Laboratory to confirm compliance with these requirements.

H. Seismic-Load-Resisting System (SLRS): The Seismic-Load-Resisting System (SLRS) is defined as all items designated "SLRS" on the Structural Drawings, including columns, beams, and braces, and their connections along grid lines denoted "SLRS" on the framing plans.

## 1.4 QUALIFICATIONS

A. Steel Fabricator's Qualifications: Fabricator shall have had not less than 5 years' experience in fabrication of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.

B. Steel Erector's Qualifications: Erector shall have had not less than 5 years' experience in erection of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.

C. Welder Qualifications: Welders, welding operators, and tackers shall be qualified in accordance with AWS D1.1 and CBC Section 2231A.5.
   1. Welders shall have a valid Welding Performance Qualification Record (WPQR) for each welding procedure to be performed.
   2. Welders whose work fails to pass inspection shall be requalified before performing further welding.
   3. Supplemental Welding Personnel Testing: Welders and welding operators performing work on bottom-flange Demand-Critical Welds shall pass Supplemental Welder Qualification Testing, as prescribed in FEMA 353, Part I, Appendix B, using the process and highest deposition rate to be used in the work. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification. Tack welders need not perform such Supplemental Testing.
   4. Qualification Period: Personnel who have not welded for a period of three or more months shall be requalified. Welding personnel required to be tested using the Supplemental Welding Personnel Testing shall be qualified by test within 12 months prior to beginning welding on the project.
   5. The Contractor shall pay costs of certifying qualifications and requalifications.

## 1.5 QUALITY ASSURANCE

A. Welding Inspector Qualifications:
   1. All Welding Inspectors shall be trained and thoroughly experienced in inspecting welding operations, and qualified as Certified Welding Inspectors (CWI) in accordance with AWS D1.1 and AWS QC1.
   2. NDT Personnel Qualifications
      a. NDT personnel shall be qualified under one of the ASNT documents referenced in this specification. NDT performed by NDT Level I personnel shall be under the close, direct supervision of an NDT Level II.
      b. Demand-Critical Welds: UT may be performed only by UT technicians certified as Level II by their employer, or as ASNT Level III certified by examination by the ASNT. Ultrasonic testing technicians who perform flaw

detection or sizing shall be trained in applicable UT procedure and shall demonstrate their competence through testing as prescribed in FEMA 353, Part I, Appendix E.

B. Bolting Inspector Qualifications: Competency shall be demonstrated through the administration of a written examination and through the hands-on demonstration by the Inspector of the methods to be used for bolt installation and inspection.

C. Submittals: The Owner's Testing Laboratory will submit the following items:
1. Quality Assurance Plan: The Quality Assurance Plan shall contain the Quality Assurance and Inspection items contained in this Section.
2. Qualifications of Owner's Testing Laboratory management and personnel designated for the project.
3. Qualification records for Owner's Testing Laboratory's Inspectors and NDT technicians designated for the project.
4. Owner's Testing Laboratory's Quality Control Plan for the monitoring and control of the Agency's operations.
5. Written Practice for Owner's Testing Agencies: The Owner's Testing Laboratory shall maintain a Written Practice for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualification and certification of inspection personnel, including those of subcontracting agencies. The Written Practice shall also describe the Agency's procedures for determining the acceptability of the structure in accordance with the applicable codes, standards, and specifications. The Written Practice shall also describe the Agency's inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.
   a. Bolting Inspection Procedures: Comply with RCSC Specification and the Quality Assurance Plan.
   b. Welding Inspection Procedures: Meet the requirements of the AWS D1.1 and the Quality Assurance Plan.
   c. Nondestructive Testing Procedures: The Written Practice shall describe the responsibility of each level of certification for determining the acceptability of material and welds in accordance with the applicable codes, standards, specifications and procedures.

## 1.6 SUBMITTALS

A. The following items shall be submitted to the Architect for review. One reproducible copy will be returned. Do not fabricate material prior to obtaining final review of submittals.
1. Manufacturer's test reports and literature describing products excluding those listed in Paragraph 1.6.B.
2. Shop and Erection Drawings. Prior to the start of fabrication and erection, submit detailed shop and erection drawings for all structural steel showing:
   a. Size and location of all structural members and connection material.
   b. Type, size and location of bolts and welds.
   c. Identification of high-strength bolted joints as snug-tight, pretensioned or slip-critical, as required by the Contract Documents.
   d. Locations where the Construction Documents require backing bars to be removed.
   e. Locations where the Construction Documents require supplemental fillet welds where backing is permitted to remain.
   f. Locations where the Construction Documents require weld tabs to be removed.
   g. Identification of members and connections of the Seismic-Load-Resisting System.
   h. Location and dimensions of the Protected Zone.
   i. Identification of welds in the Seismic-Load-Resisting System.
   j. Identification of Demand-Critical Welds.

k. Identification of connections and members, or portions thereof, to be treated as AESS.

l. Shop and erection drawings shall clearly identify revisions and revision dates in accordance with AISC2.

m. Shop drawings shall include the following additional information:
   1) Complete information necessary for the fabrication of members including cuts, copes, holes, doubler plates, stiffeners, and camber.
   2) Surface preparation and finishes, including both painting and grinding.
   3) Material grades of all members, connection material, fasteners, and weld filler metal.
   4) Connection details drawn to scale for members of the Seismic-Load-Resisting System.
   5) With each set of shop drawings include corresponding erection drawings identifying pieces.

n. Erection drawings shall include the following additional information:
   1) Identification mark of members.
   2) Orientation and relation of members to appropriate grid lines.
   3) Setting elevations for column bases.
   4) Standard and special details for field connections.
   5) Identification of joints or groups of joints in which a specific assembly order, welding sequence, welding technique, or other special precautions are required.

B. The following items shall be submitted to the Architect and Owner's Testing Laboratory. Submittal to the Architect is for record purposes only. No copies will be returned by the Architect.

1. Manufacturer's test reports and literature describing products:

   a. Structural Steel: Material test reports (MTRs), also called mill test reports, for all structural steel. MTRs shall comply with the requirements of ASTM A6. MTRs shall be accompanied by a Certificate of Compliance from the fabricator. Structural steel shall be identified in accordance with CBC Section 2203A.

   b. Fastening Material: Manufacturer's Certifications for fastener components, including bolts, nuts, washers, and direct tension indicators (if used), accompanied by a Certificate of Compliance from the Contractor. Manufacturer certifications shall contain:
      1) Heat analysis, heat number, and a statement certifying that prohibited elements were not added to produce the bolts.
      2) Results of hardness, tensile, and proof load tests, as required and performed.
      3) If galvanized, measured zinc coating weight or thickness, and the results of rotational capacity tests, including test method used (solid plate or tension measuring device) and lubricant present.
      4) Results of visual inspection for bursts.
      5) Statement of compliance with dimensional and thread fit requirements.
      6) Lot number and purchase order number.

   c. Welding Consumables: Submit the following items:
      1) Manufacturer's Certifications for electrodes, fluxes and shielding gasses to be used. Certifications shall satisfy AWS A5 requirements. In addition submit a Certificate of Compliance from the Contractor supplying the materials. Submit certifications that the product meets any additional requirements of the project.
      2) Manufacturer's product data sheets for all welding material to be used. The data sheets shall describe the product, limitations of use, recommended welding parameters, and storage and exposure requirements, including baking and rebaking.

d. Welded Stud Connectors: Submit the following items:
   1) Manufacturer's Certification that the studs, as supplied, meet the requirements of AWS D1.1.
   2) Certified copies of the stud manufacturer's test reports covering the last completed set of in-plant quality control mechanical tests for the diameter supplied.
   3) Certified material test reports from the manufacturer. The Manufacturer's Certification shall be accompanied by a Certificate of Compliance from the Contractor.

2. Bolting and Welding Procedures: Procedures shall assign responsibility to a person or position and shall contain enough detail to be useful to the workforce without reference to governing specifications. The procedures need not act as work instructions. Procedures shall be dated and indicate the person or position that has the authority to maintain the procedure.
   a. Fastener Installation Procedures: Submit written procedures for the pre-installation testing, installation, snugging, pre-tensioning, and post-installation inspection of high strength fasteners.
   b. Welding Procedure Specifications (WPSs): Welding Procedure Specifications (WPSs) shall conform to the requirements of AWS D1.1. Submit Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQR) as required by AWS D1.1, to be used on the project to the Owner's Testing Laboratory.
   c. Use forms provided in Annex E of AWS D1.1 or equivalent.
   d. Weld Sequence Procedures: Submit written procedures indicating field welding sequences for each type of connection with multiple field-welded joints, and the sequence of such connections to be field-welded at each level.
   e. Weld Shrinkage and Distortion Control Plan: Where shrinkage is likely to cause distortion or other problems, submit a mitigation plan. The contractor is responsible for determining conditions requiring a Weld Shrinkage and Distortion Control Plan.
3. Welding Performance Qualification Records (WPQRs): Written Welding Performance Qualification Records (WPQRs), in accordance with AWS D1.1, for all welders on the project. Submit documentation that the welder has passed all designated supplemental welder qualification testing required for the types of welding to be performed. Submit documentation showing that the welder continued to use the applicable welding process on an ongoing basis since the WPQR test was conducted.
4. Samples: Material samples shall be provided as requested by the Structural Engineer or Owner's Testing Laboratory.

## 1.7 STRUCTURAL STEEL PRE-CONSTRUCTION CONFERENCE

A. Prior to performing any fabrication or erection work, the Owner's Representative, Architect, Structural Engineer, and Owner's Testing Laboratory, together with Steel Fabricator personnel and Steel Erector personnel supervising the shop, field and Quality Control work shall hold a Pre-construction Conference to review submittal requirements, welding procedures, bolting procedures, fabrication and erection issues, and inspection requirements for all structural steel operations.

## 1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.

B. Structural steel shall be stored and handled in a manner that prevents damage or distortion. Discharge materials carefully; do not dump onto ground.

C. Do not store materials on the structure in a manner that might cause distortion or damage to members of the supporting structure.

D. Store structural steel members, whether on or off site, above ground on platforms, skids, or other support; store other materials in weather-tight, dry place until use.

E. Store materials to permit easy access for inspection and identification.

F. Electrode Requirements:
1. Packaging of weld filler metals shall conform to the requirements of AWS D.1.1. FCAW electrodes shall be received in undamaged moisture-resistant containers. They shall be protected against contamination and injury during shipment and storage. When removed from protective packaging and installed on machines, care shall be taken to protect the electrodes and coatings from deterioration or damage.
2. Modification or lubrication of an electrode after manufacture is not permitted, except that drying shall be permitted when recommended by the manufacturer.
3. Electrode Storage and Exposure Limits for Demand-Critical Welds: The exposure time limit for FCAW electrodes shall be based upon the results of tests as prescribed in FEMA 353 Part I, Appendix D. Spools shall be identified to facilitate monitoring of total atmospheric exposure time. FCAW electrodes that have been exposed for periods exceeding the allowable atmospheric exposure may be baked as per D1.1 if manufacturer's testing and recommendations show that baking is effective.

G. Fasteners shall be stored in a protected place. Except for ASTM F1852 "twist-off" type assemblies, clean and relubricate bolts, nuts and washers that become dry or rusty before use. F1852 fastener components may be relubricated following the manufacturer's written instructions, and must be retested after relubrication and prior to use to verify suitability for installation.

## 1.9 JOB CONDITIONS

A. Provide the Owner's Testing Laboratory with free access to places on and off job site where materials are stored or fabricated, to places where equipment is stored or serviced, and to job site.

B. Sequencing, Scheduling:
1. Notify the Architect and Owner's Testing Laboratory in sufficient time prior to shop or field fabrication and erection to permit testing and inspection without delaying Work.
2. Ensure timely delivery of items to be embedded in work of other sections; furnish setting drawings and directions for installation
3. Provide templates for setting of anchor rods.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Steel Shapes, Plates, Tube, Pipe, and other sections: As noted on drawings.

B. Standard Threaded Fasteners:
1. Machine Bolts and Nuts: ASTM A307, Grade A.
2. Plain Washers: ASTM F844.
3. Beveled Washers: ANSI B18.23.1.

C. High Strength Bolts, Nuts, and Washers:
1. ASTM A325-N, snug-tight, unless otherwise noted.
2. Bolted joints in the Seismic-Load-Resisting System shall be Slip-Critical, with pretensioned high-strength bolts and a Class A faying surface or better.

3. Twist-off-Type Tension-Control Bolt Assemblies: ASTM F1852.
4. Direct Tension Indicators: Load Indicator Washers: ASTM F959
5. Nuts for High Strength Bolts: ASTM A563.
6. Washers for High Strength Bolts: ASTM F436.

D. Welding materials:
1. Comply with AWS D1.1 with a nominal 70 ksi tensile strength.
2. Supplemental Requirements for the Seismic-Load-Resisting System:
   a. Toughness and Elongation: Weld filler metals shall be capable of providing welds with the following minimum mechanical property requirements using AWS A5 classification test methods:
      1) CVN toughness of 20 ft-lb at -20 degrees Fahrenheit.
      2) Elongation: 22% minimum.
   b. Weld filler metals shall be low-hydrogen per AWS D1.1.
   c. Weld procedures shall conform to the Hydrogen Control Method in AWS D1.1 Annex XI.
3. Demand-Critical Welds: In addition to the requirements for Seismic-Load-Resisting System welds, employ weld filler metals capable of providing welds with a minimum CVN toughness of 40 ft-lb at 70 degrees Fahrenheit, using AISC3, Appendix X test conditions and specimens in lieu of those in AWS A5.

E. Welded Stud Connectors:
1. Headed Shear Studs: AWS D1.1 "Type B" automatic end-welded headed studs made from ASTM A108, Grade 1015 or 1020.
2. Threaded Studs: Automatic end-welded threaded studs made from ASTM A108, Grades 1010 through 1020.

F. Anchor Rods and Nuts: ASTM F1554; Grade as noted on drawings.
1. Grade 55 shall be weldable per supplement S1.
2. Grade 55 shall have a minimum CVN toughness of 15 ft-lbs at 40 degrees Fahrenheit per supplement S4.
3. Grade 105 shall have a minimum CVN toughness of 15 ft-lbs at -20 degrees Fahrenheit per supplement S4.

G. Threaded Rods: ASTM A36.

H. Clevises and Turnbuckles: AISI C-1035; in addition clevises and turnbuckles shall have design strengths corresponding to the AISC Manual of Steel Construction (LRFD) with ultimate capacities at least 200% of the tabulated values.

I. Primer:
1. Interior steel: primer shall conform to SPC Paint Specification No. 13.
2. Exterior steel: primer shall conform to SPC Paint Specification No. 20 (Zinc-Rich Primer)
3. Primers shall contain no lead or chromates.
4. Contractor shall verify compatibility with finish paint.

J. Zinc-Rich Coating for Repair of Galvanized Surfaces: Zinc-rich coatings shall meet the requirements of ASTM A780.

K. Steel shall conform to the requirements of CBC Section 2202A.1.

## 2.2 FABRICATION

A. General Requirements:
1. Fabricate structural steel in accordance with AISC1 (Chapter M and the first paragraph of J2.), AISC2, and AWS D1.1 as applicable to Statically Loaded Structures, except as otherwise noted herein.

a. Assume all thermally cut edges are subject to tension stresses.
b. Delete paragraphs M4.6 and M5.1 from Chapter M of AISC1.

2. Fabricate and assemble work in shop to greatest extent possible.
3. Where possible, use procedures that do not require Architect's approval. Such approval may not be given in some circumstances.
4. Coordinate as required for attachment of other work to structural steel.
5. Where required for passage of reinforcing steel shapes, sections, plates, or bars, drill or punch holes as indicated on Contract Drawings. Notify Architect of conditions not shown or noted.
6. Allowable Tolerances: Comply with AISC1, Chapter M, and AISC2, Section 6. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt the more restrictive tolerances.
7. Architecturally Exposed Structural Steel (AESS): All structural steel denoted "AESS" on the drawings shall be fabricated in accordance with the requirements of Section 10 of the AISC2.
8. Holes and attachments to structural steel in areas designated as the Protected Zone are not allowed except as explicitly shown or noted on structural drawings.

B. Connections:
1. Shop Connections: Bolted or welded as noted.
2. Field Connections: Locate splices only where noted or approved by Architect.
3. To the extent possible, assemble structural steel in the shop prior to galvanization.

C. Bolted Joints:
1. Punch or drill holes 1/16" larger than bolt size. Material having thickness in excess of connector diameter plus 1/8" shall be drilled rather than punched.
2. Ream unfair holes, but only up to next larger bolt size and install a bolt corresponding to the new hole size. Where unfairness exceeds maximum, weld hole in base material solid and drill hole of proper size.
3. Remove burrs that would prohibit solid seating of connected parts.
4. Mark completely tightened bolts with identifying symbol.
5. Provide hardened washers over slotted holes.
6. Draw up tight, check threads with chisel or provide approved lock washers where bolts are not pretensioned.
7. Assembly with Standard Threaded Fasteners: Provide beveled washers under bolt heads or nuts resting surfaces exceeding five percent slope with respect to head or nut
8. Assembly of High-Strength Structural Bolted Joints:
   a. Meet requirements of RCSC.
   b. Seismic-Load Resisting System joints shall be slip-critical (friction-type) as defined in RCSC with Class A or better faying surfaces.
   c. Provide hardened washers under provided under the element turned in the tightening procedure of high strength bolts.
   d. Direct tension indicator washers, where used, shall be provided under the head of slip-critical high strength bolts.

D. Welded Construction: (shop and field)
1. Weld in accordance with AISC1, AWS D1.1, and CBC Chapter 22A.
2. Welding shall be performed in accordance with the WPS for the joint.
3. Welds that will be permanently exposed to view shall have burrs, flux, welding oxide air spots, and discolorations removed. Surfaces of such welds shall be reasonably smooth and uniform.
4. Exterior welds shall be watertight.
5. Exposed welds in AESS shall be ground, dressed smooth, and flush with adjacent surfaces
6. Each welder working on the project shall be assigned an identification symbol or mark. Each welder shall mark or stamp this identification symbol at each weld completed. Stamps, if used, shall be the low-stress type.

7. Before testing, all welds to be subjected to ultrasonic testing (UT) shall be given a visible mark, "for UT," accurately placed on the steel a distance of 4" away from the root of the edge preparation.
8. Groove welds shall be complete-joint-penetration welds, unless specifically designated otherwise.
9. WPSs shall be available to welders and inspectors prior to and during the welding process. Prior to welding, joint fit-up shall be verified by the welder for conformance with the WPS and AWS D1.1.
10. Supplemental Welding Requirements
    a. Maximum Preheat and Interpass Temperature: The maximum preheat and maximum interpass temperature permitted is 550° F, measured at a distance of 1" from the point of arc initiation. This maximum temperature may not be increased by the WPS, regardless of qualification testing.
    b. Nonfusible Backing: The use of nonfusible backing materials, including ceramic and copper, is permitted only with satisfactory welder qualification testing performed using the type of backing proposed for use and using the test plate shown in AWS D1.1, Figure 4.21, except that groove dimensions shall be as provided in the WPS and PQR. For nonfusible weld tabs and short segments of nonfusible backing bars used at the ends of welds between shear plates and column faces, or at the ends of continuity plate welds, special welding personnel and welding procedure qualification testing is not required.
    c. Peening, Controlled Cooling, and Post-Weld Heat Treatment (PWHT): If peening, controlled cooling, or PWHT are used, they shall be performed in accordance with AWS D1.1 and a written procedure for their performance shall be incorporated into the appropriate WPS.
        1) If insulating blankets are used to control cooling a written procedure and temperature measurements are not required.
        2) The application of heat immediately following completion of a joint to maintain a nominal temperature at or below 550° F is not considered PWHT.
    d. Intermix of Filler Metals: For Demand-Critical Welds in which different weld filler metals are used, supplemental toughness testing shall be conducted as prescribed in FEMA 353, Part I, Appendix C.
    e. Wind Velocity Limits: In the Seismic-Load-Resisting-System, in lieu of the wind speed limitations in AWS D1.1, welds using GMAW, FCAW-G, GTAW and EGW methods shall not be performed when the wind velocity in the immediate vicinity of the weld exceeds three miles per hour. Welding performed within an enclosed area, and not subject to drafts may be deemed to satisfy this requirement. For SMAW, FCAW-S, and SAW processes wind shall not affect the appearance of the molten weld puddle.
11. Welded Joint Details:
    a. Backing bars: The use of backing bars shall be in accordance with AWS D1.1, AISC3, and/or FEMA-353 as applicable. Backing bars shall be removed where required by the Contract Documents or AWS D1.1.
        1) Beam-Column Connection Joints Requiring Removal of Backing Bars: Following removal of backing, remove un-sound weld metal at the root area and any excessive weld discontinuities, and backweld. Minimize gouging and removal of base metal. A reinforcing fillet weld with a minimum leg size of 5/16" or the root opening plus 1/16", whichever is larger, shall be provided. Perform MT on the fillet weld and the immediately adjacent area.
        2) If groove weld backing is permitted to remain, the backing shall not exceed 3/8" thickness. For connections of the seismic-load-resisting system in which backing is not removed, backing shall be attached to the member or plate that does not have its surface prepared for the groove weld. Attachment shall be by either a 1/4" fillet or 1/8" groove weld along the complete bar length on the side

of the bar opposite the groove weld.

b. Weld dams are not allowed.

c. Weld Tabs:

1) Use of Weld Tabs: Welds shall be terminated at the end of a joint in a manner that will ensure sound welds. Whenever necessary, this shall be done by use of weld tabs.

a) Weld tabs shall extend beyond the edge of the joint a distance equal to a minimum of the part thickness, but not less than 1".

b) Weld tabs shall be oriented parallel to the joint preparation and to the weld direction.

c) Nonfusible weld tabs may be used in applications and locations where qualified in accordance with AWS D1.1, Section 4.

2) SLRS Beam-Column Connection Weld Tab Removal and Finish:

a) Weld tabs of SLRS connections shall be removed. Removal may be performed by air carbon arc cutting (CAC-A), grinding, chipping, or thermal cutting to within 1/8" of the base metal surface. For continuity plate weld tabs, removal within 1/4" of the plate edge is adequate. The process shall be controlled to minimize removal of base metal except for that material immediately adjacent to the weld. The edges where the weld tabs have been removed shall be finished Extra Smooth.

b) In SLRS connections, gouges deeper than 1/16" at locations of removal of weld tabs shall be repaired by welding according to the requirements of this Specification for Deep Gouges. Weld filler metal requirements for Demand-Critical Welds apply. The contour of the weld at the ends shall provide a smooth transition, free of gouges and sharp corners. A minimum radius at the corner need not be provided.

c) Following weld tab removal, finishing, and completion of any necessary repairs, the exposed ends of the weld shall be inspected using magnetic particle testing (MT) or Penetrant Testing (PT).

d. Weld toes: Weld toes, whether for groove welds or fillet welds, shall provide a smooth transition between the weld and base metal. The as-welded profile is adequate provided it satisfies the criteria of AWS D1.1, Section 5.24.

e. Weld access holes:

1) Weld access holes shall meet the dimensional, surface finish, and testing requirements of AISC1 Chapter J1.6 and AWS D1.1, except as otherwise required by the Contract Documents.

2) Where the height of the weld access hole exceeds the quantity k-tf+1½" or where the length of the weld access hole exceeds 4 tf (where k and tf are defined in AISC1), welded reinforcement is required. Notify the Architect for specific instruction.

3) At welded flange joints that are part of the Seismic Load Resisting System, the weld access hole detail shown in Figure 11-1 of the AISC3 shall be used.

4) The SLRS access hole shall be ground Extra Smooth. Gouges at SLRS access holes shall be repaired according to the requirements of this Specification. Weld filler metal requirements for the Demand-Critical Welds apply. Prior to acceptance,

5) SLRS weld access holes shall be inspected using magnetic particle testing (MT) or liquid penetrant testing (PT) and shall be free of cracks. If a welded gouge repair has been performed, magnetic particle testing (MT) shall be performed.

f. Web weld details: A minimum clear distance of 1/2" shall be provided between the weld access hole and fillet welds connecting the shear plate and beam web.

g. Welding for Moment Connection of Bottom Beam Flange shall be sequenced so as to minimize residual stresses in the joint.

h. Weave Passes: Weave passes are not permitted in groove welds in the SLRS.

i. Column continuity plate details:

1) If backing bars are used and remain in place, they shall receive a reinforcing fillet weld between the backing bar and column flange. No fillet weld should be placed between backing bar and continuity plate.

2) Weld terminations near the end of the column flange tips may be completed using weld tabs. Weld tabs shall be removed to within 1/4" of the continuity plate edge and the surface finished Extra Smooth. Following finishing, the edge shall be inspected using MT. For continuity plate welds, terminations near the internal radius of the member need not be made using weld tabs. Fillet weld terminations between the continuity plate and column web shall be approximately 1/4" from each end of the joint

j. Tack Welds in the SLRS Protected Zones: Tack welds in the SLRS Protected Zones are permitted only if they are incorporated into a required weld.

E. Camber: Provide camber as indicated on contract drawings in accordance with AISC1 Chapter M2.1.

F. Welded Connectors: Install in accordance with AWS D1.1 and manufacturer's recommendations. There shall be no porosity or evidence of lack of fusion between the end of the stud and the steel member.

G. Repair of Discontinuities in Protected Zone of Seismic-Load-Resisting System.

1. Repair of Discontinuities: If erection aids within the Protected Zone cannot be avoided, the Structural Engineer's approval of the aid's placement, use, and the repair method is required. Air carbon arc gouging is permitted for the removal of welds to within 1/8" of the base metal surface. Any remaining weld deposits shall be removed by grinding to a depth 1/16" below the surface, faired to adjacent surfaces on a slope not to exceed 1:5.

2. Air Carbon Arc Cutting and Thermal Cutting: Air carbon arc cutting (CAC-A) and thermal cutting is permitted in the Protected Zone with the prior approval of the Structural Engineer for the removal of backing bars and weld tabs, as specified in these documents.

3. Gouges in members and connections in the Seismic-Load-Resisting System shall be repaired according to the requirements of this Specification. Weld filler metal requirements for the Seismic-Load-Resisting System apply, unless otherwise noted.

H. Surface Finish:

1. Flush Surfaces: Welds in butt joints required to be flush shall be finished so as to not reduce the thickness of the thinner base metal or weld metal by more than 1/16", or 5% of the material thickness, whichever is less. Remaining reinforcement shall not exceed 1/32" in height. However, all reinforcement shall be removed where the weld forms part of a faying or contact surface. All reinforcement shall blend smoothly into the plate surfaces with the transition areas free from undercut.

2. Finish Methods and Values: Chipping and gouging may be used, provided these methods are followed by grinding. Where surface finishing is required, surface shall be Extra Smooth, unless otherwise noted or specified in this document. Measurement of surface finish values by visual appearance or tactile comparison is acceptable.

I. Repair of Gouges: Gouges are not permitted in areas requiring an Extra Smooth finish surface, or where specifically prohibited by AWS D1.1 or this Specification. Repair of gouges meet the following requirements, unless otherwise noted:
   1. Shallow Gouges: Gouges up to 3/16" deep shall be removed by grinding as per D1.1, or to a radius of not less than 3/8".
   2. Deep Gouges: Gouges deeper than 3/16" shall be repaired by welding. Prior to welding, gouges shall be ground to provide an Extra Smooth contour with a radius not less than 3/8". The repair area shall be preheated to a temperature between 400° F and 550° F, measured at the point of welding approximately one minute after removal of the heating source, or shall be preheated in accordance with AWS D1.1 Annex XI for high restraint. A written repair WPS for the application shall be followed. Following completion of welding, the area shall be ground Extra Smooth, with fairing of the welded surface to adjoining surfaces where applicable, and shall be inspected using magnetic particle testing (MT).
   3. The transitional slope after gouge removal shall not exceed 1:5.

## 2.3 FINISHES

A. Prime Painting:
   1. Surfaces to be painted:
      a. See SECTION 09 90 00 "PAINTING AND COATING" for structural steel surfaces permanently exposed to weather.
      b. Apply one coat of primer to AESS members and members to be painted unless otherwise noted.
      c. Do not prime paint following surfaces:
         1) Surfaces to be encased in concrete except initial 2".
         2) Surface to be field welded.
         3) Surface to receive sprayed-on fireproofing.
         4) Contact surfaces joined by high-strength bolts.
   2. Preparation of Surfaces:
      a. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from steel prior to painting.
      b. Where hand-cleaning methods are inadequate, clean in accordance with SPC-SP1, SPC-SP 2, or SPC-SP 7, as required.
   3. Painting:
      a. Apply primer in accordance with manufacturer's specifications to provide minimum dry film thickness of 1.0 mils per coat.
      b. Permit thorough drying before shipment.
      c. Do not prime in temperatures lower than 45 degrees Fahrenheit.

B. Galvanization
   1. Galvanize steel where required by the Drawings or by other sections of the Specification.
   2. Galvanize Shapes in accordance with ASTM A153.
   3. Galvanize Fasteners in accordance with ASTM B695, Class 40 minimum.

## 2.4 SOURCE QUALITY ASSURANCE

A. The Owner's Testing Laboratory will:
   1. Review ladle analysis and certificates of compliance. Where certification is questionable, test material to verify compliance per CBC Section 2231A.1.
   2. Inspect shop fabrication per CBC Section 2231A.2.
   3. Provide the management, personnel, equipment, and services required to perform the quality assurance functions required below.
   4. Verify that no improper attachments to the Protected Zone have been made.
   5. Forward copies of all product and procedure certificates, data sheets, and test and inspection reports to the Owner, Architect, Structural Engineer, Contractor, and DSA.

B. Welding Inspection: The Welding Inspector will perform the tasks indicated in the following list. This list shall not be considered exclusive of any additional inspection tasks that may be necessary to meet the requirements of AWS D1.1, CBC Section 2231A.5, and the Quality Assurance Plan

1. Review and understand the applicable portions of the specifications, the Contract Documents and the shop drawings for the project.
2. Verify that all applicable welder qualifications, welding operator qualifications and tack welder qualifications are available, current, accurate, and in compliance with these specifications.
3. Verify welder identification and qualification. Verify that any required supplemental welder qualification testing, if required for the joint, has been executed and that the welder has passed.
4. Verify that each welder has a unique identification mark or die stamp to identify welds.
5. Verify that all applicable Welding Procedure Specifications (WPSs), with Procedure Qualification Records (PQRs) as needed, are available, current and accurate, and comply with AWS D1.1 and this specification.
6. Verify that an approved Welding Procedure Specification (WPS) has been provided and that each welder performing the weld has reviewed the WPS. A copy of the appropriate WPS shall be available for each joint, although need not be present at each joint location.
7. Review mill test reports for all main member and designated connection base material for compliance with the project requirements.
8. Verify base material identification with the contract documents.
9. Verify the electrode, flux and shielding gas certifications for compliance with the Contract Documents.
10. Verify welding consumables with the approved WPSs.
11. Verify that electrodes are used only in the permitted positions and within the welding parameters specified in the WPS.
12. Verify that electrodes and fluxes are properly stored, and that exposure limits for the welding materials are satisfied.
13. At suitable intervals, observe joint preparation, assembly practice, preheat temperatures, interpass temperatures, welding techniques, welder performance and any post-weld controlled cooling and heat treatment to ensure that the requirements of the WPS and AWS D1.1 are satisfied.
14. At suitable intervals, verify current and voltage of the welding equipment in application of the WPS, if needed, by a calibrated amp and voltmeter. Current and voltage shall be measured near the arc with this equipment.
15. Inspect the work to ensure compliance with AWS D1.1 and the specified weld acceptance criteria.
16. Schedule NDT technicians in a timely manner, after the visual inspection is complete and the assembly has cooled. The final NDT on a specific weld shall be performed at least 24 hours after the welding has been completed.
17. Mark the welds, parts, and joints that have been inspected, and accepted, with a distinguishing mark or die stamp, or maintain records indicating the specific welds inspected and accepted by each inspector.
18. Document the accepted and rejected items in a written report. Transmit the report to the designated recipients in a timely manner.

C. Nondestructive Testing of Welded Joints:

1. Magnetic Particle Testing: Magnetic Particle Testing (MT) shall be conducted by the Owner's Testing Laboratory at the frequency designated in Table 2-1. MT shall be performed in accordance with AWS D1.1, and FEMA 353, Part I Appendix F.
2. Ultrasonic Testing: Ultrasonic testing (UT) shall be conducted by the Owner's Testing Laboratory for the percentage of joints designated in Table 2-1. UT shall be performed in accordance with AWS D1.1.
3. Weld Acceptance Criteria shall be in accordance with AWS D1.1. Regions of welds that cannot be inspected shall be identified and recorded, and the Structural

Engineer shall be notified.

4. K-Area Welding Inspection: After welds of continuity plates and doubler plates have cooled to ambient temperature, test column webs for cracking using liquid penetrant (PT) or magnetic particle testing (MT) over a zone 3" above and below each weld.

Table 2-1. Nondestructive Testing Requirements:

| | Nondestructive Testing Requirements | |
|---|---|---|
| Weld Category | Complete-Joint-Penetration Welds[1] | Partial-Joint-Penetration Welds and Fillet Welds |
| Welds not described below | No NDT required unless otherwise noted | No NDT required unless otherwise noted |
| SLRS welds not described below | MT 25% of joints, full length[2]<br>UT 25% of joints, full length[2] | MT 25% of joints,<br>6" spot at random[2] |
| Top-flange joints at cantilever beam connections[3] | MT 100% of joints, full length<br>UT 100% of joints, full length | MT 100% of joints, full length |
| Demand-Critical Welds | MT 100% of joints, full length<br>UT 100% of joints, full length[4] | MT 100% of joints, full length |

Notes:

1. UT is required only when the weld thickness is 5/16" or greater.
2. If any joint fails testing, test 100% of joints until 40 consecutive welds pass. The testing rate may then be reduced to 25%.
3. Test joint on each side of cantilever beam support.
4. Reduce the rate of UT to 25% if after 40 welds have been inspected, an individual welder's reject rate is less than 5%.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine units of Work to be placed and verify that all anchor rods have been installed properly and have sufficient bolt and thread elevation.

B. Do not begin erection before unsatisfactory conditions have been corrected.

### 3.2 ERECTION

A. General Requirements:

1. Erect structural steel in accordance with AISC1 Chapter M, AISC2, and AWS D1.1 Structural Steel Welding Code as applicable to Statically Loaded Structures.
2. Requirements for bolted and welded joints specified in Part 2 of this Specification shall also apply to field connections unless otherwise noted.
3. Erection Tolerances: Do not exceed the erection tolerances specified in AISC2, Section 7. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt the more restrictive tolerances.
4. Where erection requires performing work of fabrication on site, conform to applicable standards for fabrication.
5. Architecturally Exposed Structural Steel (AESS): All structural steel denoted "AESS" on the drawings shall be erected in accordance with the requirements of Section 10 of the AISC2.
6. Ensure steel is plumb, level, and aligned before making final connections.

B. Anchor rods shall be set in conformance with Section 7.5 of AISC2.

C. Field Cutting or Alteration: There shall be no field cutting, alteration, or repair of structural steel members or of connections without prior review and approval by the Architect. Structural elements with fabrication errors or that do not satisfy tolerance limits shall be repaired. Submit drawings showing reasons for, and details of, proposed corrective work.

D. Temporary Shoring and Bracing: Provide shoring and bracing as needed until permanent lateral-support is in place and complete with connections of sufficient strength to bear the imposed loads. Contractor is responsible for identifying the need for temporary shoring and bracing.

E. Erection Procedures: Control erection procedures and sequences to avoid problems caused by temperature differentials and weld shrinkage, and other sources of expansion and contraction.

F. Leveling of Column Base Plates: Contractor shall specify the means and methods for leveling the column base plates during erection. The leveling method shall have sufficient strength to support the imposed loads, including construction loading.

G. Field Assembly:
   1. Clean bearing surfaces and surfaces to be in permanent contact before assembling members.
   2. Do not fasten members with bearing joints designated on the drawings before abutting surfaces have been brought completely into contact.
   3. Bolted Construction:
      a. Installation of high-strength bolts shall conform to ASTM A325 for slip-critical or snug-tightened type joints, as applicable, in accordance with RCSC. Provide washer under head or nut of high strength bolts. Washer shall be provided under the element being turned during tightening. Bolts in welded connections shall be tensioned after completion of welding.
      b. At bolted joints designated as Slip-Critical or that require pretension, use Twist-off-Type Tension-Control bolt assemblies or Direct Tension Indicators.
      c. Do not use flame cutting to align bolt holes except as permitted by RCSC specifications. Ream holes that must be enlarged to admit bolts. Do not enlarge holes to a diameter greater than 1." When reaming beyond 1/32", drill or ream to the next larger hole size and use the next larger size bolt.
   4. Mill scale shall be removed from the column in the area where the beam flanges will be welded to the column.

H. Gas Cutting: Use of flame cutting torch will be permitted only after the Architect's prior written approval and only where metal cut will not carry stress during cutting, and cut surfaces will not be visible. When thermal cutting is permitted, cutting shall be done with a mechanically guided torch or a torch controlled using a guide bar.

I. Field Touch-Up Painting: After erection, touch-up paint field connections and abrasions resulting from the Work of this Section with same paint used for shop prime painting.

J. Remove and repair galvanized surface as required for field welding in accordance with ASTM-A780, A2; required thickness is 100 micro-inches. Touch up with zinc-rich coating. Repair material shall extend at least three inches beyond edges of damaged areas.

K. Protected Zone: Attachments to structural steel in the Protected Zone, other than spot welding of metal deck to beams and welding of metal studs to braces as shown on structural drawings, are not allowed

## 3.3 CLEANING

A. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding of fireproofing, concrete, or other finishes as

applicable.

B. Architecturally Exposed Structural Steel (AESS).
   1. If temporary braces or erection clips are used, remove braces and clips in a manner which prevents unsightly surfaces.
   2. Tack welds shall be ground smooth.
   3. Holes shall be filled with weld filler metal or body solder and ground smooth.
   4. All operations shall be performed such that the close fit and neat appearance of the structure will not be impaired.

## 3.4 FIELD QUALITY ASSURANCE

A. Owner's Testing Laboratory will:
   1. Verify proper anchor rod group location, elevation, and orientation prior to placement of concrete foundations, and again subsequent to placement of concrete foundations prior to arrival of structural steel.
   2. Perform field welding inspection and testing in accordance with the requirements in Part 2 of this Specification for shop fabrication, unless otherwise noted.
   3. Inspect and test high strength bolted joints in accordance with RCSC and CBC Sections 2231A.2 and 2231A.6.
   4. Sample and test bolt assemblies that include direct tension indicators, on a daily basis to verify proper indication of deformation with required bolt tension for each size and lot. The Inspector shall have a torque wrench, calibrated daily, to verify correlation with proper tension as installation proceeds. Test at least 10 percent of the bolts with a minimum of two per connection from the start of bolting and until waived by the DSA Field Engineer upon demonstration of continued good workmanship.
   5. Inspect erected structural steel as required to establish conformity of Work with reviewed shop drawings and Contract Drawings.
   6. Perform testing and inspection of welded stud connectors in accordance with requirements of AWS D1.1. and CBC Section 2231A.3, except that the test studs shall be subjected to a 90 degree bend test by striking them with a heavy hammer. After the bend test, the weld section shall not exhibit any tearing or cracking.
   7. Inspect structural steel to verify that the Protected Zones of members of the Seismic-Load-Resisting System are free of damage and attachments not approved by the Structural Engineer.
   8. Forward copies of all test and inspection reports to the Owner, Architect, Structural Engineer, Contractor, and DSA.

**END OF SECTION**

# SECTION 05 40 00

# COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. Section Includes: Provision of lightgauge steel stud and joist framing. Work includes, but is not necessarily limited to the following:
   1. Non-load bearing steel stud framing at exterior walls.
   2. Interior stud wall and ceiling framing with studs.
   3. Framing accessories.

B. Related Sections:
   1. Section 05 12 00 - Structural Steel Framing.
   2. Section 05 50 00 - Metal Fabrications.
   3. Section 09 20 00 - Gypsum Board Assemblies.
   4. Section 09 22 16 - Non-Structural Metal Framing.

### 1.2 REFERENCES

A. Requirements of the GENERAL CONDITIONS and DIVISION 01 apply to all Work in this Section.

B. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
   1. California Code of Regulations, Title 24, 2007 edition, also known as California Building Code (CBC).
   2. American Society for Testing and Materials (ASTM).
   3. Federal Specifications (FS).
   4. American Welding Society (AWS) D1.3: "Structural Welding Code - Sheet Steel."
   5. American Iron and Steel Institute (AISI): "Specifications for the Design of Cold-Formed Steel Structural Members."
   6. Steel Stud Manufacturer's Association (SSMA).
   7. Metal Lath Association (MLA): "Specifications for Metal Lath and Furring."
   8. Society of Protective Coatings (SSPC).

### 1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with fire-resistance ratings as indicated and as required by governing authorities and codes.
   2. Provide materials, accessories, and application procedures which have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.
   3. Comply with CBC Section 2203A.3 and AISI requirements for design and identification of cold-formed steel.

B. Steel stud system shall conform to referenced AISI documents.

C. Installer: Company specializing in performing the work of this Section with minimum 3 years' documented experience.

D. Welders: Qualified in accordance with AWS D1.3 for welding process, position, type of weld and type of steel.

## 1.4 SUBMITTALS

A. Submit in accordance with provisions of Section 01 32 19, "Submittal Procedures."

B. Product Data: Manufacturer's ICBO report, specifications and installation instructions for steel studs, fasteners, and accessories.

C. Experience of installer if requested by Architect.

## 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01 60 00, "Product Requirements."

B. Protect framing from rusting and damage.

C. Deliver in manufacturer's unopened containers or bundles fully identified with name, brand, type and grade.

D. Store inside a dry, ventilated space, and protect framing from rust and damage.

## 1.6 JOB CONDITIONS

A. Coordinate stud sizes and layouts with the work of the various trades. Where ductwork, conduit, piping, casework, and other such items exceed indicated available space, increase stud sizes or make other minor modifications as necessary to accommodate the work at no change in cost of the Work.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Acceptable Manufacturers: Any member of Steel Stud Manufacturer's Association (ICBO #ER-4943P).

## 2.2 MATERIALS

A. Sheet Steel: ASTM A653, A1008 or A1011.

B. Studs and tracks:
1. See drawings for size and gauge.
2. Galvanization per ASTM A653 with G60 minimum.

C. Cold-Rolled Furring Channels: As specified in Section 09 22 16, "Non-Structural Metal Framing."

D. Vertical Deflection Clips (non-load-bearing framing): (If so required by project requirements and as indicated on approval shop drawings.) Manufacturer's standard bypass and head clips as required, capable of isolating wall stud from upward and downward vertical displacement of primary structure using mechanical fasteners. Acceptable Manufacturer: The Steel Network, Inc. (ICC criteria AC261 for metal to metal connections and ICC ESR-1903) or engineer approved equal.

1. VertiClip® series or equal to. Mechanical attachment to structure and screw attachment to stud web using step-bushings to permit frictionless vertical movement.

E. Drift Clips (non-load-bearing framing): (If so required by project requirements and as indicated on approval shop drawings.) Manufacturer's standard bypass and head of wall clips (as required), capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure using mechanical fasteners. Acceptable Manufacturer: The Steel Network, Inc. (ICBO criteria AC261 for metal to metal connections and ICBO# ER-5623) or engineer approved equal.
1. Drift Clip series or equal. Mechanical attachment to structure and screw attachment to stud web using step-bushings to permit frictionless vertical and lateral movement.

F. Sliptrack: as indicated on approved drawings. Acceptable Manufacturers: Sliptrack Systems (ICBO #ER-5344) or engineer approved equal.

G. Partition Stiffeners or Bridging: Unpunched channel shape, formed of 16-gauge steel to required dimensions.

H. Powder-Driven Fasteners:
1. Tempered-steel pins with special corrosive-resistant plating or coating.
2. Pins shall have guide washers to accurately control penetration.
3. Fastening shall be accomplished by low-velocity, piston-driven, powder-accentuated tool.
4. Pins and tool shall be Hilti Fastening Systems DN-32-P8 (ICBO #2388) or equal product substituted per Section 01 60 00.

I. Expansion Bolts: Hilti Fastening Systems "Kwik Bolt 3 Concrete Anchors" (ICC ESR-1385), or equal product substituted per Section 01 60 00.

J. Welding Electrodes: AWS low hydrogen, rod number and diameter as approved by the Owner's Testing Agency.

K. Bracing: Provide cross diagonal straps, attached as indicated on the Drawings and per stud manufacturer's specifications for frame stability.

L. Touch-up Primer for Galvanized Surfaces: SSPC Paint 20 zinc rich.

M. Metal Screws: Self-drilling and self-tapping; No. 8 and larger as noted on Drawings. Screws shall penetrate substrate by a minimum of three full threads exposed. Use low profile heads as required by architectural finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine all parts of the supporting structure and the conditions under which studs will be installed.

B. Notify the Architect, in writing, of any conditions detrimental to the proper and timely completion of the Work.

C. Do not proceed with the installation of steel studs until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Coordinate details and requirements of other Work which adjoins or fastens to studs and requires backing or special support framing included in this Section.
   1. Items requiring backing or support include, but are not necessarily limited to casework, wall-specialties, and similar items.
   2. Obtain Architect's approval of backing method proposed to satisfy requirements of this Section which differs from methods noted or shown.

## 3.3 INSTALLATION

A. Tracks shall be securely anchored to supporting structure, with fasteners specified at not more than 24-inches on center.

B. Complete, uniform, and level bearing support shall be provided for the bottom track at each bearing-stud location. Install full metal shims below bottom track at stud locations as needed, or set bottom track in high-strength grout.

C. Abutting or intersecting pieces or track shall be securely anchored to a common structural element or spliced together.
   1. Do not splice studs.

D. Bearing wall studs shall sit in top and bottom track with 1/16" maximum gap between wall stud and track web.
   1. Studs shall be aligned or plumbed and securely fastened to the flanges of both top and bottom track.
   2. Space studs 16-inches on center maximum unless otherwise noted on Drawings.

E. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Connect vertical (and/or drift) deflection clips to studs and anchor to primary building structure in accordance with manufacturer's recommendations.

F. Framed wall openings shall include a header and multiple studs at each edge of opening as indicated on Drawings.

G. Diagonal bracing shall be installed at locations indicated for frame stability.

H. Install bridging as indicated on Drawings.

I. Form corners and intersections of partitions with three studs. Provide additional studs as indicated or required.

J. Wire tying of framing members shall not be permitted.

K. Welded connections shall be made by resistance spot fusion welding, fillet welding, or plug welding and shall be done in accordance with the latest recommended procedures and practices of the American Welding Society.

L. Do not cut or notch stud flanges or cut additional opening in stud web.

M. Field abrasions and welds shall be touched up with zinc rich primer.

N. Erection Tolerances: Install cold formed metal framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8-inch in 10 feet as follows:

1. Space individual framing members no more than plus or minus 1/8-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

O. Provide all angles, clips and other miscellaneous pieces necessary to attach light gauge framing to building structure or to attach other materials to light gauge framing.

P. Do not bridge building expansion and control joints with cold formed metal framing. Independently frame both sides of joints.

Q. Install in built-up exterior framing members, such as headers, sills, boxed joists and double studs, inaccessible upon completion of framing work.

## 3.4 INSTALLATION OF FIRE-RATED ASSEMBLIES

A. Install studs which are components of fire-rated wall assemblies as indicated.

## 3.5 BACKING IN STUD PARTITIONS

A. Securely weld or screw cut sections of unpunched stud to at least three stud or furring supports, leaving flat surface of backing stud web to receive attachment of object to be secured.

B. Verify that any pre-drilling of backing and attachment of spacers to prevent crushing of collateral material is done prior to application of collateral material.

C. If it is determined by the Architect that backing was not provided for any items as required, the Contractor shall remove the finish material and install backing. The Contractor shall patch and refinish surface to match adjacent area and finish.

## 3.6 FIELD QUALITY CONTROL

A. Owner's Testing Agency will:
1. Provide continuous inspection of welding, including prior fit-up, welding equipment, weld quality, and welder certification in accordance with AWS and CBC Section 1701A.5.5.1.
2. Provide continuous inspection during installation as required to establish conformity of Work requirements.

**END OF SECTION**

# SECTION 05 50 00

# METAL FABRICATIONS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes shop fabricated metal items:
1. Ladders at elevator pits.
2. Steel pipe handrails and guardrails.
3. Barrier gate at interior stairwell for exit control.
4. Structural supports for miscellaneous attachments.
5. Stair Nosings.
6. Anchor bolts for sill plates and columns.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
2. Section 05 12 00 – Structural Steel: Structural steel column anchor bolts.
3. Section 05 31 13 – Steel Floor Decking: Bearing plates and angles for metal deck bearing, including anchorage.
4. Section 09 90 00 – Painting and Coating: Field applied paint finish.

### 1.2 REFERENCES

A. American Architectural Manufacturer's Association:
1. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.

B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A167.
5. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
6. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
7. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
8. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings.
9. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings.
10. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
11. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
12. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
13. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric).
14. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.

15. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric).
16. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
17. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Paint.
2. SSPC-SP3 - Power Tool Cleaning.

E. State of California Title 24:
1. Striping code for the visually impaired.

F. National Ornamental & Miscellaneous Metals Association:
1. NOMMA Guideline 1 - Joint Finishes.

## 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

C. Samples: If specifically requested for specified products; required for alternate products.
1. Stair Nosings: Submit two 6-inch samples of the specified system.

D. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS and CBC qualification within previous 12 months.

## 1.4 QUALITY ASSURANCE

A. Finish joints in accordance with NOMMA Guideline 1.

## 1.5 QUALIFICATIONS

A. General: Fabricator and installer specializing in the work of this Section with minimum three (3) years documented experience.

B. Welding: Performed by certified welders per AWS and CBC Section 2209A and 2212A.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

## 1.7 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on shop drawings.

## PART 2 - PRODUCTS

## 2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A500, Grade B.

C. Stainless Steel Sheet: ASTM A167, Type 304 flashing, 20 gauge.

D. Plates: ASTM A283.

E. Pipe: ASTM A53, Grade B, Schedule 40.

F. Fasteners:
   1. General: Galvanized steel fastenings or other non-rusting types for exterior steel work.
   2. Exposed in Finished Surfaces: Tamperproof countersunk Phillips flat head screws, unless otherwise shown; finish to match adjacent surfaces.
   3. Plastic Screw Anchors:
      a. General: Type PSA, manufactured by Hilti, Inc.
      b. Alternate Manufacturers: Compatible products manufactured by Star Anchors and Specialty Fasteners, Inc., or accepted equal.

G. Bolts, Nuts, and Washers: ASTM A325, galvanized to ASTM A153 for galvanized components.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.

J. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20, Type I Inorganic.

## 2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221, B221M, Alloy 6063, Temper T5.

B. Sheet Aluminum: ASTM B209, B209M. Grain matched.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210, B210M, Alloy 6063,Temper T6.

D. Aluminum-Alloy Bars: ASTM B211, B211M, Alloy 6063, Temper T6.

E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.

F. Aluminum-Alloy Die Castings: ASTM B85.

G. Bolts, Nuts, and Washers: Stainless steel.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Wire: #9 gauge aluminum wire.

## 2.3 COMPONENTS

A. Following is list of principal items only. Refer to Drawings for items not specifically scheduled.

B. Posts, Ladders, Handrails and Guardrails: As detailed; galvanized finish.

D. Plastic Cement: FS SS-C-153, Type 1.

E. Non-Shrink Grout:
1. General: "Embeco 636" manufactured by Master Builders, Inc.
2. Alternate Manufacturers: Comparable products manufactured by W.R. Meadows, Inc. or accepted equal.

## 2.4 STAIR NOSINGS

A. Manufacturers – Cast Aluminum Retrofit Stair Nosing:
1. Balco Inc.; www.balcousa.com;
2. American Stair Tread.
3. Wooster Products Inc.
4. Safe T Metal Company.
5. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

B. Stair Nosings System Description: 6 inches wide x length 6 inches less than stair tread width, with anchors for anchoring into concrete.
1. Stair noising assemblies shall be anchored to substrate.
2. Stair nosing treads shall be ribbed.
3. Stair nosing treads shall be slip resistant.
4. Stair nosing treads shall be removable and replaceable.
5. Retrofit stair nosings shall be bevel back.
6. Stair nosing treads shall meet OSHA Barrier-Free Code requirements for stair design in public buildings.

C. Materials:
1. Stair nosing system: Model RS-607LS.
   a. Cast Aluminum: Class 30 Aluminum, tread plate.
2. Insert Treads: Santoprene.
3. Fasteners required for complete installation to manufacturer's instructions:
4. Stair Nosings for Renovations: Concrete Screws.

D. Fabrication:
1. Fabricate stair nosing assemblies as detailed. Provide anchors and accessories necessary
   for complete installation.
   a. Fabricate stair nosings with the depth of nose to measure underside 6 inches.
   b. Provide Santoprene insert treads of specified color.
   c. Provide specified anchors.
2. Package components with anchors.

E. Finishes:
1. Aluminum tread plates shall be:
   a. Mill finish.
   b. Heat-treated for strength.
2. Santoprene Insert Treads:
   a. Color: As selected by Architect from standard color selection.

## 2.5 BARRIER GATES

A. Manufacturers:
   1. Sharon Companies Ltd.; www.sharonstair.com.
   2. Substitutions: Section 01 60 00 – Product Requirements: Product options and substitutions.

B. Barrier Gates: Manufacturer's standard swing gate assembly with steel spring hinges and rubber bumper between barrier/gate assembly and rail post.

## 2.6 ANCHOR BOLTS

A. Anchor Bolts: ASTM A307; 3/4 inch steel bolt, standard, hex headed, with nut and washer; unfinished.

## 2.7 FABRICATION

A. Workmanship:
   1. General: Shop assemble work in largest practical sections; minimize field connections. Grind smooth parts exposed to view; remove weld marks and leave free of fabrication marks. Miter corners and edges unless otherwise shown. Make members true to length so assembling may be done without fillers. Bends, twists, open joints in finished members, or projecting edges or corners at connections will not be permitted. Miter, cope, and block carefully to produce tight hairline joints. Provide lugs, clips, connections, bolts, and fastenings necessary to complete fabrication.
   2. Galvanizing: Treat all areas burned off or damaged during fabrication with specified repair compound.
   3. Reinforcement: Provide proper reinforcement for hardware, and other fabricated metal work, as required.
   4. Welding: All exposed welds shall be architectural grade. Use sequence welding to minimize distortion and heat stresses. Weld by shielded electric arc process per AWS. Use continuous welding along entire area of contact, except where spot welding is permitted. Grind all welds smooth on exposed surfaces. Spot welding not permitted on exposed surfaces.

B. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

C. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

D. Fabrications:
   1. General: Fabricate the following items, complete as shown:
   2. Steel Pipe Guardrails, Handrails, Drinking Fountain Rails and Posts: Standard weight steel tube and bar stock as indicated; welded, plugged and ground smooth; weld to mounting plates where required.

## 2.8 FACTORY APPLIED FINISHES - STEEL

A. Prepare surfaces to be primed in accordance with SSPC Standards.

B. Galvanized Structural Steel Members: Galvanize after fabrication to ASTM A123. Furnish minimum 1.25 oz/sq ft. galvanized coating.

C. Galvanized Non-structural Items: Galvanized after fabrication to ASTM A123. Furnish minimum 1.25 oz/sq ft. galvanized coating.

D. Barrier Gate Components: Completely remove oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter from surface of steel in accordance with SSPC-SP3, "Power Tool Cleaning."
   1. Shop Primer: Immediately after shop fabrication and cleaning, spray apply primer to a minimum dry film thickness as recommended by primer manufacture, but not less than 2.0 mils. Apply one coat hi-solids red oxide anti corrosive primer meeting federal specifications TT-664, TT-P-636, and SSPC1364.

E. Stainless Steel Sheet: No. 4 satin luster finish.

## 2.9 FACTORY APPLIED FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: AAMA A41 anodized, prepared with mechanical pretreatment, anodized to clear color.

B. Interior Aluminum Surfaces: AAMA A41 anodized, prepared with mechanical pre-treatment, anodized to clear color.

## 2.10 FABRICATION TOLERANCES

A. Squareness: 1/8 maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive Work.

## 3.2 PREPARATION

A. Clean and strip primed steel items to bare metal and aluminum where site welding is required.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

## 3.3 INSTALLATION

A. Performance:
   1. General: Install with workmen skilled in the particular type of work required
   2. Coordination: Deliver miscellaneous metal items to be installed in concrete or masonry, complete with all clips, anchors, or bolts necessary to secure them in place.
   3. Workmanship: Set work plumb and true; properly assemble and erect in a rigid an workmanlike manner. Do cutting, punching, drilling and tapping for

attachment of other work coming into contact with fabricated metalwork where indicated or as directed. Do necessary cutting, drilling, and fitting for installation of fabricated metal work. Execute drilling, cutting, and fitting carefully; when required; fit work at job before finishing. No burning in field permitted. Replace, or repair parts damaged or injured during erection in an acceptable manner. Drill holes for fasteners to exact diameter as recommended by fastener manufacturer. Oversized holes or holes not properly located that produce misalignment of fastener will be rejected.

4. Galvanizing: Treat areas burned off or damaged during fabrication or erection with specified repair treatment.
5. Field Touch-up: Touch-up damaged surfaces and field welds of steel, scheduled to be painted, per SSPC standards. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.
6. Protection: After erection, provide proper protection for fabricated metal items from other construction operations.

B. Installation:
   1. General: Install the metal items, complete as shown.
   2. Handrail and Guardrail Posts: Set posts in pipe sleeves set in concrete and anchor as shown; touch-up all primed surfaces damaged during installation.

C. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

D. Field weld components indicated on Drawings. All welds and steel exposed to view shall be architectural.

E. Perform field welding in accordance with AWS D1.1.

F. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.

**END OF SECTION**

# SECTION 06 10 53

# MISCELLANEOUS ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes roof curbs, cants, and perimeter nailers; blocking in wall openings; wood furring and grounds; telephone and electrical panel back boards; and preservative treatment of wood.

### 1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. American Wood-Preservers' Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
   2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
   3. AWPA C27 – Plywood – Fire-Retardant Treatment by Pressure Process.

C. ASTM International:
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

D. California Building Code, California Code of Regulations, Title 24, 2007 Edition (noted herein as CBC) Chapter 23A.

E. National Institute of Standards and Technology:
   1. NIST PS 20 - American Softwood Lumber Standard.

F. The Redwood Inspection Service:
   1. RIS - Standard Specifications for Grades of California Redwood Lumber.

G. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

H. Western Wood Products Association:
   1. WWPA G-5 - Western Lumber Grading Rules.

### 1.3 SUBMITTALS

A. Section 01 32 19 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   1. Lumber Grading Agency: California Building Code Standard No. 23-1, Classification, Definition and Methods of Grading for all Species of Lumber.
   2. Plywood: California Building Code Standard No. 23-2.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Lumber Grading Rules: RIS; WCLIB.

B. Structural Lumber and Plywood:
1. Lumber and plywood graded and grade-marked per standards specified.
2. Lumber:
   a. Size per industry standards for nominal sizes shown; S4S.
   b. Moisture content of framing: Maximum 19 percent when installed and 15 percent maximum at time of close-in. In areas with dry hot summer months, maximum at close-in to be 12 percent.
   c. Sills on concrete or masonry: Redwood foundation grade, or pressure treated No. 1 Douglas Fir.
   d. Structural framing: Douglas Fir with grades as noted below unless otherwise specified on drawings. All grades per WCLIB STD grading rules #17.
      1) Permanently exposed framing: Select structural grade with no box heart.
      2) Except per Paragraph 2.1.B.2.d.1) above, minimum grades are: 1x, 2x4, 2x6, and 2x8 studs and plates D.F. No. 1; 4x and larger D.F. No. 1; Blocking DF No. 2.
      3) Miscellaneous framing - D.F. No. 2
   e. Applicable WCLIB paragraphs for framing:

| | |
|---|---|
| 1x, 2 x 4 to 4 x 4 | par. 124 |
| 2 x 6 to 4 x 16 Structural joists and planks | par. 123 |
| Beams (6x), beams and stringers | par. 130 |
| Posts (6x) | par. 131 |

   f. Splits and checks: Limited to 1x the depth of the member.
   g. Do not use warped/twisted and checked members regardless of grade marks.
3. Plywood:
   a. Structural plywood: Grade marked for conformance with CBC and Uniform Building Code Standard 23-2. "Product Standard PS-1-95" and fabricated with exterior glue. Grades shall be as required on drawings.

### 2.2 ACCESSORIES

A. Fasteners and Anchors:
1. General requirements for fasteners:
   a. Fastenings shall be of adequate size, spacing and number to resist design loads under intended use, and types shall be appropriate for the materials or conditions for which used.
   b. Include washers, pre-drilling, etc. required for proper installation.
   c. For exterior work, fastenings shall be hot dip galvanized, non-ferrous, or made rust-resistant by approved methods.
   d. Fasteners at Treated Wood: Hot dip galvanized.
2. Nails and nailing not otherwise shown or specified:
   a. Comply with requirements of CBC.
   b. For securing materials to hardened concrete or masonry: Hardened steel masonry nails or Tapcon screws.
   c. For Framing, Plywood and General Structural Wood Work.

1. All nails for structural use shall be of bright common wire with full round heads and shall be of sufficient length to exceed required penetration into the supporting member by 1/8 inch.
2. Framing nails shall be hand driven and shall meet the dimensional requirements for common wire nails Table 23A-III-C-2 of CBC.
3. Plywood Nails: Hand driven nails shall conform to requirements above.
4. Pneumatically (machine) driven nails shall not be used without a valid ICBO Report. Contractor shall provide for submittal to DSA and the Architect/Engineer a current ICBO Report, nail sample with nail dimensions (head and shank diameter and nail length) and specifications for the nailing device. Nailing device must be adjustable regarding the depth of driving the nail. Use of pneumatic (machine) nailing is subject to a satisfactory sample jobsite demonstration for each project. The approval is subject to continued satisfactory performance. If nail heads penetrate the outer ply more than would be normal for a hand hammer or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory. Nails and nailing shall also conform to 1 above.
5. Nails into PTDF material to be galvanized.

3. Bolts:
   a. ASTM A-307, standard semi-finished machine bolts as shown or required; with malleable iron washers or steel plate washers, unless otherwise shown, shall be provided under all bolt heads and nuts.
   b. Bolts in concrete: Wedge or expansion anchors set after casting: Simpson Wedge – All and Powers Wedge Bolt.
   c. Anchor bolts: ASTM A307 with standard head or ASTM A36 with plate washer. No upset threads allowed. No L or J bolts allowed. Other grades of steel are as required on drawings and/or the Structural Steel Section.
   d. Bolts at Treated Wood: Hot dip galvanized.
4. Powder-actuated fastenings: Use only as approved by the Architect/Engineer and DSA; operators shall be qualified.
5. Framing hardware: Fabricated sheet metal timber framing connectors: Manufactured from hot-dipped galvanized steel by "Simpson Company", Dublin, CA; "USP Lumber Connectors", Livermore, CA, or approved equivalent. Connectors shall be at least 16 gauge material, (1/8 inch plate materials where welded), unless otherwise noted, punched for nailing. Nails and nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. Fabricate heavy hardware from ASTM A-36 steel per Division 5, Metals. Hardware intended for exterior use shall be galvanized.

## 2.3 FACTORY WOOD TREATMENT

A. Preservative Treatments:
   1. Field-applied treatment to light framing: For all lumber and plywood contacting or within 6-inches of soils and contacting concrete or masonry, except pressure treated materials. Use pressure treated materials for all items embedded in concrete, or in contact with soil.
      a. F.S. TT-W-570a(1), non-creosote type.
      b. Apply two brush coats; or fill-immersion dip not less than 15 minutes; or as required to thoroughly saturate all surfaces after cutting. Air dry 2-hours minimum before installation.
      c. Acceptable Products: Cuprinol #10, Darworth Co., Avon, CT; Termin-8, Jasco.
   2. Framing lumber and plywood that is directly exposed to weather or soil:

a. Pressure-treated materials shall be in accordance with CBC 2303.3 with preservative retention levels as follows: (16/F+$^3$)
   1) Alkaline/Copper/Quaternary (ACQ), 0.25 lbs. Preservative per foot$^3$ above ground, 0.40 lbs. Preservative per foot$^3$ in contact with ground.
b. Preservative types:
   1) Alkaline/ Copper/ Quaternary (ACQ).
c. Treated lumber shall bear an AWPA treatment stamp on each piece.
d. Field treatment of end cuts and holes in pressure treated materials F.S. TT-W-472B and per Paragraph 2.3.A.2.a.1) above.

B. Fire Resistant Treatment for all Interior Wood and Plywood:
1. All wood used inside the building envelope and roof curbs at openings is to be fire treated as follows:
   a. Pressure treatment, AWPA C20 for lumber and AWPA C27 for plywood, Interior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of 25/450. Product and application process must be recommended by manufacturer of treatment as being suitable for painting. Fire retardant to be applied by a California State Fire Marshal approved licensed Contractor.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify substrate conditions are ready to receive blocking, curbing and framing.

### 3.2 PREPARATION

A. Coordinate placement of blocking, curbing and framing items.

### 3.3 INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members, crown side up.

C. Construct curb members of solid wood sections.

D. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

E. Coordinate curb installation with installation of decking and support of deck openings, and parapet construction.

F. Space framing and furring 16 inches on center.

G. Secure sheathing to framing members with ends over firm bearing and staggered.

H. Install pre-painted telephone and electrical panel back boards with plywood sheathing material where required. Size back boards 12 inches beyond size of electrical and telephone panel.

### 3.4 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment.

B. Brush apply one coat of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

## 3.5 SCHEDULES

A. Roof Blocking and Curbs; Wood Blocking; Nailers; Shims: Douglas Fir species, 19 percent maximum moisture content, pressure preservative treatment.

B. Telephone and Electrical Panel Boards: 3/4 inch thick, square edges, site brush applied preservative treated.

**END OF SECTION**

# SECTION 06 20 00

# FINISH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes:
1. Interior trim and millwork.
2. Hardware and attachment accessories.
3. Plastic-laminate-clad MDF ceiling panels at High-Bay ceiling coffers.

B. Related Sections:
1. Section 06 10 53 - Miscellaneous Rough Carpentry: Grounds and support framing.
2. Section 06 41 00 - Custom Cabinets: Shop fabricated custom cabinet work.
3. Section 07 90 00 - Joint Protection.
4. Section 08 21 00 - Flush Wood Doors.
5. Section 09 90 00 - Painting and Coating: Painting and finishing of finish carpentry items.

C. Alternates: Refer to Section 01 23 00 – Alternates, for description of work under this Section affected by Alternates.

### 1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A135.4 - Basic Hardboard.
2. ANSI A156.9 - Cabinet Hardware.

B. APA-The Engineered Wood Association:
1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

C. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. American Wood-Preservers' Association:
1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.

E. Federal Specification Unit:
1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

F. Hardwood Plywood and Veneer Association:
1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

G. National Institute of Standards and Technology:
1. NIST PS 20 - American Softwood Lumber Standard.

H. U. S Department of Commerce National Institute of Standards and Technology:
1. DOC PS 1 - Construction and Industrial Plywood.
2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
3. DOC PS 20 - American Softwood Lumber Standard.

I. Woodwork Institute:

1. WI – *Architectural Woodwork Standards*.

## 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, finishes, and accessories to a minimum scale of 1-1/2 inch to one foot.
1. Furnish a WI - Certified Compliance label on first page of shop drawings.

C. Product Data:
1. Submit technical data on plastic lumber.
2. Submit data on fire retardant treatment materials and application instructions.

D. Samples:
1. Submit two samples of wood trim 6 inch long.

E. Certification: Submit copy of fabricators WI certified compliance certificate.

## 1.4 QUALITY ASSURANCE

A. Perform work in accordance with WI (Woodwork Institute) *Architectural Woodwork Standards*, Custom Grade.

B. Issue WI Certified Compliance Certificate to Architect prior to delivery of millwork and provide WI Certified Compliance Labels on all items of millwork.

C. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).

D. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing results of the reinspection.

E. Upon completion of the installation, provide a WI Certified Compliance Certificate.

F. Apply label from agency approved by authority having jurisdiction to identify each preservative treated and fire retardant treated material.

## 1.5 QUALIFICATIONS

A. Fabricator: Authorized to provide WI Certified Compliance Certificate.

## 1.6 REGULATORY REQUIREMENTS

A. Conform to UBC and UL requirements for fire ratings.

B. Conform to Flame Spread Classifications of Interior Millwork contained within the Appendix of the WI *Architectural Woodwork Standards* for flame spread ratings.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Conform to Section 2 of WI – *Architectural Woodwork Standards*.

C. Store materials in ventilated, interior locations under constant minimum temperatures of 70 degrees F and maximum relative humidity of 50 to 55 percent.

D. Protect work from moisture damage.

## 1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

## 1.9 SEQUENCING

A. Sequence work to ensure utility connections are achieved in orderly and expeditious manner.

## 1.10 COORDINATION

A. Coordinate work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

# PART 2 - PRODUCTS

## 2.1 FABRICATORS

A. Active member of the Woodwork Institute, licensed by WI to provide WI certified Compliance Certificates and Labels for the products and materials specified in this Section. Woodwork Institute Phone: (916) 372-9943.

B. Substitutions: Under provisions of Section 01 60 00.

## 2.2 WOOD-BASED COMPONENTS - GENERAL

A. Materials specified under Millwork Manual Section Numbers refer to the following lumber grades:
1. Section 3, Lumber Grades – Hardwood/Softwood.
2. Section 4, Sheet Products.
3. Section 5, Finishing.
4. Section 6, Interior and Exterior Millwork.
4. Section 7, Stairwork and Rails.
5. Section 8, Wall Surfacing.
6. Section 9, Doors.
7. Section 10, Casework.
8. Section 11, Countertops.

B. Wood fabricated from old growth timer is not permitted.

C. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless otherwise noted, provided it is clean and free of contamination; identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

D. Wood Products: Comply with the following:
1. Recycled Content of Medium-Density Fiberboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than <**Insert number**> percent.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
3. Composite Wood and Agrifiber Products: No added urea formaldehyde (NAUF).

E. Core: Medium-density fiberboard (MDF) panels with a formaldehyde-free adhesive system meeting the requirements of *Architectural Woodwork Standards*. Particleboard not permitted.
1. Manufacturer: SierraPine, 3010 Lava Ridge Court, Suite 220, Roseville, California 95661. Toll Free (800) 676-3339. Phone (916) 772-3422. Fax (916) 772-3415. Website www.sierrapine.com. E-mail info@sierrapine.com.

F. MDF Panels with Formaldehyde-Free Adhesive System:
1. Medium-Density Fiberboard (MDF) Panels: "Arreis".
a. Material:
1) Wood Fiber: 100 percent post-industrial recycled wood residuals.
2) Binder: Formaldehyde-free adhesive system.
b. Conformance: ANSI A208.2, industrial-grade MDF.
c. Certifications:
1) SCS Certified: Post-industrial recycled wood fiber. No added formaldehyde.
2) CHPS Compliant: Section 01350 approved.
3) CPA Certified: Environmentally Preferable Product.
4) FSC Certified.
d. Panel Thickness: As indicated on Drawings.
1) Thickness Tolerance: Plus or minus 0.005 inch, average from nominal or deviation from average.
e. Physical Properties, based on 3/4-Inch Thickness, ASTM D 1037, Part A:
1) Density: 48 pounds per cubic foot.
2) Internal Bond: 115 psi.
3) Modulus of Rupture: 4,800 psi.
4) Modulus of Elasticity: 480,000 psi.
5) Modulus of Hardness, Janka Ball: 1,000 pounds.
6) Screw Holding: Required to pull 1-inch #10 sheet metal screw.
a) Face: 225 pounds.
b) Edge: 175 pounds.
7) Water Absorption: 8 percent average, 24-hour soak.
8) Thickness Swell: 5 percent average, 24-hour soak.
9) Linear Expansion: 0.30 percent, dimensional change in length and width due to humidity change.
10) Flame Spread Rating, ASTM E 84: Class C (3).
11) Moisture Content: 4 to 6 percent average, oven-dry basis.
12) Formaldehyde Emissions: As low as 0.01 ppm.
2. Medium-Density Fiberboard (MDF) Panels: "Medite II".
a. Material:
1) Wood Fiber: 100 percent post-industrial recycled wood residuals.
2) Binder: Formaldehyde-free adhesive system.
b. Conformance: ANSI A208.2, industrial-grade MDF.
c. Certifications:
1) SCS Certified: Post-industrial recycled wood fiber. No added formaldehyde.
2) CHPS Compliant: Section 01350 approved.
3) CPA Certified: Environmentally Preferable Product.
4) FSC Certified.
d. Panel Thickness: As indicated on Drawings.
a. Thickness Tolerance: Plus or minus 0.005 inch, average from nominal or deviation from average.
e. Physical Properties, Based on 3/4-Inch (19-mm) Thickness, ASTM D 1037, Part A:
1) Density: 48 pounds per cubic foot.
2) Internal Bond: 150 psi.
3) Modulus of Rupture: 5,500 psi.
4) Modulus of Elasticity: 550,000 psi.
5) Modulus of Hardness, Janka Ball: 1,150 pounds (522 kg).

6) Screw Holding: Required to pull 1-inch #10 sheet metal screw.
   a) Face: 350 pounds (159 kg).
   b) Edge: 275 pounds (125 kg).
7) Water Absorption: 6.5 percent average, 24-hour soak.
8) Thickness Swell: 3.5 percent average, 24-hour soak.
9) Linear Expansion: 0.27 percent, dimensional change in length and width due to humidity change.
10) Flame Spread Rating, ASTM E 84: Class C (3).
11) Moisture Content: 6 percent average, oven-dry basis.
12) Formaldehyde Emissions: As low as 0.01 ppm.

## 2.3 LUMBER MATERIALS

A. Softwood Lumber: NIST PS 20; Custom grade in accordance with WI; minimum moisture content of 6 percent and maximum of 12 percent. Douglas Fir species, with vertical grain, of quality capable of opaque finish.

B. Hardwood Lumber: Custom grade in accordance with WI; minimum moisture content of 6 percent and maximum of 12 percent.

## 2.4 INTERIOR TRIM - PAINT GRADE

A. Finger jointed kiln-dried pine is acceptable for all areas except high moisture areas.

B. Trim profiles: Mill standard shapes as indicated.

C. Paint-grade trim: Pre-prime at mill.

## 2.5 INTERIOR TRIM - STAIN GRADE

A. Fabricate in accordance with Section 6 of *Architectural Woodwork Standards*:
   1. Base, Casing, and Trim:
      a. Species: White Birch.
      b. Grade: Custom.
      c. Cut: Quarter sawn.
      d. Finger Jointing: Not permitted.
      e. Finish: Transparent.
      f. Color: Equivalent to "Toast 28-95" by Marshfield Door Systems.

## 2.6 PLASTIC LAMINATE

A. Plastic laminate for plastic-laminate-clad MDF ceiling panels at High-Bay ceiling coffers: As specified in Section 06 41 00 – Custom Cabinets.
   1. Color/Pattern: As selected by Architect.

## 2.7 ADHESIVE

A. Adhesives: Type 1 adhesive recommended by WI to accommodate application in accordance with the Appendix to the Millwork Manual.

B. Formulation: Exterior type per AWPA C20, consisting of organic-resin solution, insoluble in water, thermally set in wood by kiln drying.

C. Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.

## 2.8 ACCESSORIES

A. Nails: Size and type to suit application, galvanized finish for interior use, stainless steel for exterior use.

B. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application; galvanized finish for interior use, stainless steel for exterior use.

C. Lumber for Shimming and Blocking: Softwood lumber of Douglas Fir species.

D. Primer: Alkyd primer sealer.

E. Wood Filler: Solvent base, tinted to match surface finish color.

F. Ceiling Panel Cladding System for High Bay Coffers: Graph, by Fry Reglet Corporation; www.fryreglet.com. Architectural ceiling panel cladding system including trims, terminations, miscellaneous metal and subframes, clips, fasteners and other devices for secure anchorage of panels to conventional drywall or other substrate provided for this purpose.
   1. Framing: All framing components to be fabricated from extruded 6063 T5 aluminum.
      a. Finish: Factory powder paint; "Black".

## 2.9 FABRICATION

A. Fabricate to WI Custom standards.

B. Shop assemble work for delivery to site, permitting passage through building openings.

C. Fit exposed sheet material edges with matching hardwood edging. Use one piece for full length only.

D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

E. Saw-Kerfing Flat Trim: To prevent cupping and warping, saw cut the backs of flat trim nominal 1 x 8 and wider, or nominal 2 x 6 and wider.

F. Ceiling Panel Cladding System for High Bay Coffers:
   1. Factory miter and weld aluminum framing components to form subassemblies including 2-way, 3-way and 4-way intersections, inside and outside corners and custom intersections as detailed in manufacturer's shop drawings. Ceiling panel cladding system shall be capable of providing a 1/4" reveal joint, with an anodized aluminum exposed element bordering each panel horizontally, vertically or in both directions in accordance with Architectural drawings. All other details, including base, head, corners, intersections etc. shall be fabricated in accordance with the Architectural drawings.
   2. Install infill panels in a non-progressive manner; point accessible. Affix panels to framework with co-extruded clips having an independent lab certification pullout loading of 10 pounds per inch of attachment.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify that surfaces and openings are ready to receive work and field measurements are as instructed by the fabricator.

B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.

C. Verify adequacy of backing and support framing.

D. Beginning of installation means acceptance of existing conditions.

## 3.2 INSTALLATION

A. Install work in accordance with WI Manual of Millwork, Custom quality standard.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install components and trim with nails at 6 to 8 inches on center.

E. Countersink mechanical fasteners at exposed and semi-exposed surfaces.

F. Method of attachment, including the type, size, frequency, and/or spacing of anchoring devices and fasteners shall comply to WI Manual of Millwork minimum requirements or be as indicated on the drawings.

G. Ceiling Panel Cladding System for High Bay Coffers:
   1. Install grid components in accord with manufacturer's installation instructions and approved shop drawings. Grid components must be installed plumb, true and level within tolerances established by grid components manufacturer.
   2. Allow panels with a wood substrate to acclimate to the project environmental conditions prior to installation.
   3. Erect ceiling panels plumb, level, square, true to line, securely anchored and in proper alignment and relationship to work of other trades.

## 3.3 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Sand work smooth.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.

D. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials or that will be permanently concealed from view.

E. Site Finishing: Refer to Section 09 90 00.

## 3.4 ERECTION TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

**END OF SECTION**

# SECTION 06 41 00

# CUSTOM CABINETS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes custom-fabricated cabinet units; counter tops; cabinet hardware; preparation for installing utilities in cabinets; and shop finishing.

B. Related Sections:
1. Section 06 10 53 - Miscellaneous Rough Carpentry: Grounds and support framing.
2. Section 06 20 00 - Finish Carpentry: Related trim not specified in this section.
3. Section 09 65 00 – Resilient Flooring: Rubber base at exposed bases of casework.
4. Section 22 30 00 - Plumbing Equipment: Plumbing utilities and fixtures.
5. Section 26 01 00 - Basic Materials and Methods: Power, signal, and data wiring.

### 1.2 REFERENCES

A. Air Quality Management District.

B. American National Standards Institute:
1. ANSI A156.9 - Cabinet Hardware.
2. ANSI A208.1 - Mat-Formed Wood Particleboard.

C. California Building Code:
1. CBC - Chapter 16.

D. Federal Specification Unit:
1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

E. National Electrical Manufacturers Association:
1. NEMA LD 3 - High Pressure Decorative Laminates.

F. South Coast Air Quality Management District:
1. SCAQMD Rule 1168 – Adhesive and Sealant Applications.

G. San Mateo County Community College District Design Standards:
1. Design Standard – Casework.

H. Woodwork Institute:
1. WI - Manual of Millwork.

### 1.3 DEFINITIONS

A. Exposed Portions - All Grades: Surfaces visible when doors and drawers are closed; underside of bottoms of cabinets over 4 feet above finished floor; cabinet tops under 6 feet above finished floor or if over 6 feet and visible from upper building level or floor; visible front edges of web frames, ends, divisions, tops, shelves, and hanging stiles; visible sloping tops of cabinets; visible portions of bottoms, tops, and ends in front of sliding doors.
1. Additional Exposed Portions - Premium Grade Only
   a. Visible surfaces in open cabinets or behind glass.

b. Interior faces of hinged doors.

B. Semi-Exposed Portions: Shelves; divisions; interior face of ends, backs, and bottoms; drawer sides, subfronts, backs, and bottoms; underside of bottoms of cabinets between 2-1/2 and 4 feet above finished floor; interior faces of hinged doors, except Premium Grade; visible surfaces in open cabinets or behind glass for Custom Grade and all rooms designated as storage, janitor, closet, or utility.

C. Concealed Portions: Toe space; sleepers, web frames, stretchers, and solid sub-tops; security panels; underside of bottoms of cabinets less than 2-1/2 feet above finished floor; flat tops of cabinets 6 feet or more above finished floor except if visible from upper building level; 3 non-visible edges of adjustable shelves; underside of countertops, knee spaces, and drawer aprons; faces of cabinet ends of adjoining units that butt together.

## 1.4 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
1. Apply WI Certified Compliance Label to first page of shop drawings.

C. Product Data: Submit data for hardware accessories.

D. Samples:
1. Submit two 8 by 10 inch size samples, illustrating cabinet finish and edge treatment.
2. Submit two 8 by 10 inch size samples, illustrating counter top finish and edge treatment.
3. Submit two samples of drawer pulls and hinges, illustrating hardware finish.

E. Certification: Submit copy of fabricator's WI certified compliance certificate.

## 1.5 QUALITY ASSURANCE

A. Perform work in accordance with WI (Woodwork Institute of California) Manual of Millwork, Custom Grade.
1. Mark each unit of architectural woodwork with WI Certified Compliance Label indicating quality grade required.

B. Contractor to arrange for and pay costs of WI inspections, and obtain WI Certified Compliance Label on each unit of casework indicating grade specified.

C. Millwork specified shall be manufactured in accordance with the standards established in the Manual of Millwork of the Woodwork Institute, current edition, in the grade or grades hereinafter specified or as shown on the drawings. If the manufacturer of millwork is not a WI licensee, Contractor shall furnish to Architect, prior to installation, a Certificate of Reinspection by the WI indicating that the millwork in question meets the requirements of the WI grade specified. If the manufacturer of millwork is a WI licensee, each unit of millwork shall bear the WI Certified Compliance grade stamp indicating the grade specified, and by the completion of the job WI Certified Compliance Certificates shall be provided indicating the grade specified. The foregoing shall not be construed to limit the power and authority of Architect to reject millwork which does not, in Architect's opinion, meet with any one or more of the specifications of the contract.

## 1.6 QUALIFICATIONS

A. Fabricator: Authorized to provide WI Certified Compliance Certificate. Fabricator shall be equipped for and experienced in doing work, including fabricating, finishing, and installing, equal to standards specified, and be able to provide evidence of such experience to the Architect's and District's satisfaction. Failure to meet these qualifications may be sufficient cause for rejection.

## 1.7 MOCKUP

A. Construct mockup of full size base cabinet and upper cabinet including hardware, and accessories.

B. Locate where directed by Architect.

C. Approved mockup may be accepted as part of Work.

## 1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect units from moisture damage.

## 1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. During and after installation of Work of this section, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

## 1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

# PART 2 - PRODUCTS

## 2.1 COMPONENTS

A. General:
   1. Material Grade: WI Custom Grade unless otherwise noted.
   2. Lumber and Plywood: Kiln-dry to equilibrium moisture content suitable for fabrication in shop and use intended. Particleboard not permitted.

B. Lumber, Solid Stock:
   1. Concealed Portions: Paint grade Birch.

C. Plywood: Marine plywood, surfaced 1 side.

D. Hardboard: ANSI A135.4, tempered, smooth surface both faces.

E. Medium Density Fiberboard: ANSI A208.2.

F. High Pressure Decorative Laminate: NEMA LD 3, GP50 for horizontal surfaces, GP28 for vertical surfaces, CL20 for cabinet liner surfaces, BK20 for undecorated backing sheets, PF42 for post forming, FR50 for fire-retardant surfaces;
   1. Manufacturer: Nevamar Corp.; Wilsonart; Formica; Pionite; or equal.
   2. Colors and textures: Multiple colors to be selected by Architect from District standard color palette:
      a. Nevamar ARP textured finish:
         1) Alpine Essence ES5001.
         5) Jett Black S6053.

G. Melamine Laminate: Low pressure decorative, ALA approved.

H. Sheet Metal Components: Stainless steel, Type 304 with #4 satin finish, 16 gauge.

## 2.2 ACCESSORIES

A. Adhesive for High Pressure Decorative Laminates: Urea formaldehyde cold setting or phenol resin with catalytic agent.

B. Plastic Edge Banding: 3mm PVC, black, at plastic laminate finished cabinets. Self-edges, T-mold or bull-nosed laminate edges are unacceptable.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; US26D finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Hardware:
   1. General Requirements:
      a. General: Furnish necessary screws, staples, bolts or other fastenings of proper size and type to secure items in position and, where exposed, to match finish of hardware item fastened.
      b. Finish: Exposed hardware; US26D (satin chromium plated).
      c. Keying: Key groups of locks the same in accordance with the Owner's directions.

   2. Typical hardware except where specifically noted otherwise.
      a. Pulls at Drawers and Doors:
         1) General: Provide U-shaped wire pulls or equally accessible pull hardware at all accessible casework.
         2) 1 per drawer unless otherwise shown; solid stainless steel wire pull, 4 inches center-to-center.
         3) Manufacturer: Trimco 562-4.

   3. Hinges at 3/4-inch Thick Doors:
      a. Self closing concealed hinge, stainless steel, heavy duty.
      b. 1 pair typically; 1-1/2 pair where more than 3 feet high, 170-degree swing, self-closing.
      c. Manufacturer: Blum, #BH71T6550, or equal; with minimum 170 degree opening.

   4. Drawer Slides:
      a. 3/4 partial extension or full extension steel slides: 125 pounds load capacity minimum

b. Finish: Stainless steel, white epoxy coated, with nylon ball bearing rollers and integral positive stops.
c. Manufacturer: Accuride, model 4032, or equal.

5. Locks for Cabinet Doors:
   a. Manufacturer: Olympus Lock Inc.
   b. Function: 777 Series.
   c. Description: Door cabinet lock, 1-7/16" throw for Schlage large format IC classic core. Core must be ordered separately (not supplied by Olympus).
   d. Finish: 626.

6. Locks for Cabinet Drawers:
   a. Manufacturer: Olympus Lock Inc.
   b. Function: 888 Series.
   c. Description: Door cabinet lock, 1-7/16" throw for Schlage large format IC classic core. Core must be ordered separately (not supplied by Olympus).
   d. Finish: 626.

7. Catches: Magnetic, with plastic housing.

8. Shelf Hardware:
   a. Standards:
      1) Steel, zinc plated.
      2) Finish: US32, satin finish.
      3) Manufacturer: Knape and Vogt Mfg. Co., "No. 255ZC"; or equal.
   b. Supports:
      1) Steel, zinc plated.
      2) Finish: US32, satin finish.
      3) Manufacturer: Knape and Vogt Mfg. Co., "No. 239ZC"; or equal.

9. Door and Drawer Silencers:
   a. Gray rubber.
   b. Manufacturer: Builders Brass Works, Model W06, or equal.

10. Seismic Restraints at all shelving.

11. Coat Hooks:
   a. Base: 1-3/4 inches H x 1-1/4 inches W.
   b. Projection: 3 inches.
   c. Conforms to ANSI/BHMA L33113.
   d. Material: Cast aluminum.
   e. Finish: Polished aluminum.
   f. Manufacturer: Ives #571 Coat Hook.

12. Metal Label Holders:
   a. Provide metal label holders on every casework door and drawer.
   b. Holders are sized to receive commercially available, standard office-type name badges that can be printed using standard office computer applications and standard office printers.

## 2.3 EPOXY RESIN WORK SURFACES

A. Manufacturers:
   1. Durcon Incorporated; www.durcon.com
   2. Kewaunee Scientific Corporation; www.kewaunee.com

3. Fisher-Hamilton; www.fisherhamilton.com
4. Substitutions: Section 01 63 00 – Product Options and Substitutions.

B. Materials:
1. General: Material shall be a monolithic, filled epoxy resin product and shall consist of a polymerized cast resin material formulated to provide a work surface with high chemical resistance characteristics. The combination of epoxy resin and asbestos free inert materials shall be oven-cured in molds to obtain maximum chemical resistance, then removed from the molds and oven tempered to achieve maximum physical strength and stability. Surfaces shall have a uniform low-sheen surface and the finished material shall be extremely hard and resistant to scratches and abrasion.
2. Thickness: 1" thick (industry standard).
3. Edges and Corners: Furnish exposed work surface edges and corners, except as indicated, with a 1/8" machined top edge with blended radius corners.
4. Surface: Furnish worksurfaces as flat.
5. Backsplashes: Supplied loose for field application in the same material and thickness as countertops. Install 4" high curbs, unless otherwise indicated on drawings. Bond backsplashes to the countertops at jobsite. Include top mounted end curb backsplash where worksurfaces abut walls, fume hoods, and locations detailed on drawings.
6. Color: Black Onyx (industry standard).

## 2.4 FABRICATION

A. General: Manufacture to Custom Grade standards, except where specifically noted otherwise, per Section 15 of WI Manual of Millwork. Provide WI Certified Compliance Label for grade specified, to each elevation of casework.

B. Construction:
1. General: Style A; Type I, frameless construction with doweled joints. Multiple self-supporting units fastened together to form a larger unit. Completely face exposed and semi-exposed surfaces with plastic laminate. Interior faces of hinged doors: Faced with same laminate as exposed surface. As far as practical, fabricate casework complete as a unit in the shop; backs required.
2. Door and Drawer Fronts: 3/4 inch flush overlay; Type A.
3. Shelving: One of the following:
   a. Douglas Fir, solid-stock, Custom Grade for opaque finish.
   b. Douglas Fir plywood, Custom Grade for opaque finish; with 3/8 inch minimum edge-banding or Architect approved machine-applied-type edge banding.
   c. Plastic laminate faced plywood.
   d. Thicknesses: Per WI Standards; 3/4 inch minimum thickness, 1 inch thickness for spans between 2'-9" and 4'-0". Any facings shall be in addition to these thicknesses.
   e. Shelf spans greater than 4'-0" not permitted.
4. Filler Panels: As required, to match cabinets as shown.

C. Countertops:
1. General: Fabricate as shown, in longest practical length; minimum number of joints. Make joints neat and watertight; abutting ends splined and adjoining surfaces flush; ease exposed edges.
2. Core Material: Medium density fiberboard, or close grain hardwood plywood. Thickness: As shown; not less than 3/4 inch.
3. Backsplash: Height, type, and edge: As shown on drawings.

D. Epoxy Resin Countertops:

1. Fabrication: Provide in longest practical lengths. Bond joints with a highly chemical and corrosion resistant epoxy grout. Provide 1/8" drip groove on underside of exposed edges set back 1/2" from edge at all sink areas and where shown on drawings. All exposed edges to be molded or finished.
2. Thickness Tolerances: Each corner of top shall not deviate more than plus or minus 1/16" from nominal.
3. Size Tolerances: Length, plus or minus 1/8". Width, plus or minus 1/16".
4. Squareness: Compare the diagonal corner-to-corner measurements across the width of each work surface. The diagonal measurements must be within 1/16".
5. Penetrations: Location of cutouts and drillings: Plus or minus 1/8". Sizes of cutout and drillings: Plus or minus 1/16".
6. Warpage: Check work surface for warpage before fabrication. Measure in unrestrained condition. Work surface will be accepted for use if there is no gap exceeding 1/16" in a 36" span.

E. Casework Hardware:
1. General: Prefit; remove for application of finish. Keep hardware with casework to which it has been prefit; reinstall after casework is anchored in place, as shown.
2. Hinges: Four (4) No. 8 screws into end panel and door panel; 1-1/2 pair on 7'-0" high cabinet doors; tall cabinet doors must swing 180 degrees when adjacent to low cabinets without interference from counter top.
3. Magnetic Catches: One catch on cabinet doors up to 48 inches high; two catches (top and bottom) on cabinet doors over 48 inches high.

F. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

G. Fit shelves, doors, and exposed edges with matching veneer for wood cabinets and plastic edge binding for plastic laminate cabinets. Use one piece for full length only.

H. Cap exposed high pressure decorative laminate finish edges with plastic edge binding.

I. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

J. Apply high pressure decorative laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

K. Fabricate metal counter top surfaces pressure glued to plywood core without visible joints.

L. Mechanically fasten back splash to counter tops with steel brackets at 16 inches on center.

M. Fabricate cabinets and counter tops with cutouts for plumbing fixtures, inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

## 3.2 INSTALLATION

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified. Provide WI Certified Compliance Certificate for installation.

B. Casework:
1. General: Install level, with tight joints between units; scribe edges tofit adjacent structure. Secure to blocking or plates in wall or to casework carriers with flathead screws to permit removal; screw penetration of not less than 1 inch into 2 inch nominal blocking or framing is required.
2. Filler Panels: Scribe to cabinets and abutting structure.

C. Countertops:
1. General: Install level, using concealed fasteners, with tight joints; scribe to fit wall surfaces.
2. Countertop Supports: Install as shown.

D. Hardware:
1. General: Check hardware upon delivery to site; store in an orderly manner. Fit and install in place without marring or injuring either hardware or casework.
2. Coat Hooks: Install coat hooks at interior side of all Office doors, mounted at +66 inches AFF, centered.

E. Set and secure casework in place; rigid, plumb, and level.

F. Use fixture attachments in concealed locations for wall mounted components. Attach to blocking in walls per DSA requirements.

G. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.

H. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch Do not use additional overlay trim for this purpose.

I. Secure cabinet and counter bases to floor using appropriate angles and anchorages. Provide a bead of silicone caulk where casework base meets floor, prior to installation of rubber base, to ensure that floor cleaning activities do not damage the structural integrity of the casework base. Provide rubber base around exposed bases of casework, to create a unified appearance at the base of walls and casework.

J. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

## 3.3 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

## 3.4 CLEANING

A. Section 01 74 00 – Cleaning: Final cleaning.

B. Immediately following installation, clean casework (including counters, shelves, hardware, fittings, and fixtures) to remove dirt, stains, scratches, and abrasions. Protect casework against damage by other trades; repair or replace damaged and defaced material at no cost to Owner.

## 3.5 JOBBING

A. General: Six (6) months after final acceptance of the building, and at any time within a year after acceptance when so directed, examine casework doors, drawers, fittings, etc., and perform such fitting and adjustments as necessary to put items in good condition and working order.

**END OF SECTION**

# SECTION 07 21 16

# BLANKET INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes formaldehyde-free fiberglass thermal and sound control insulation made with non-toxic thermosetting resin.

B. Related Sections:
1. Section 07 27 00 - Air Barriers: Air barrier materials adjacent to insulation.
2. Section 07 84 00 - Firestopping.
3. Section 07 90 00 - Joint Protection.
4. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM C165 - Test Method for Measuring Compressive Properties of Thermal Insulations.
2. ASTM C411 – Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
3. ASTM C612 – Specification for Mineral Fiber Block and Board Thermal Insulation.
4. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2001.
5. ASTM C1104 - Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
6. ASTM C1304 - Standard Test Method for Assessing the Odor Emission of Thermal Insulation Materials.
7. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
8. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2001.
9. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
10. ASTM E119, - Test Methods for Fire Tests of Building Construction and Materials.
11. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C; 1999.
12. ASTM E970 - Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

B. California Integrated Waste Management board (CIWMB):
1. Section 01 35 00 – Special Environmental Requirements.

C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

E. California Building Code: 2007 CBC, Chapter 7.

## 1.3 SYSTEM DESCRIPTION

A. Materials of This Section: Provide thermal protection to air seal materials at building enclosure elements in conjunction with air barrier materials in Section 07 27 00.

B. Performance Requirements: Provide products that have been manufactured, fabricated and installed to the following criteria:
   1. Surface Burning Characteristics, Unfaced (ASTM E84): Flamespread index 25, smoke developed 50.
   2. Recycled Glass Content: 25 percent.
   3. Combustibility (ASTM E136): Noncombustible.
   4. Formaldehyde Content: Free of formaldehyde.

## 1.4 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on manufacturer's specifications, product characteristics, performance criteria, limitations, and installation instructions.

C. Manufacturer's Certificate: Submit manufacturer's certification that insulating materials comply with California Quality Standards for insulation materials; CBC, Section 5311.

## 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E84.
   2. Fire-Resistance Ratings: ASTM E119.
   3. Combustion Characteristics: ASTM E136.

## 1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

## 1.7 COORDINATION

A. Coordinate the Work with Section 07 27 00 for air seal materials.

# PART 2 - PRODUCTS

## 2.1 BLANKET INSULATION

A. General: Refer to Section 01 60 00 – Product Requirements.

B. Manufacturers:

1. General: Products are manufactured by Johns Manville International, Inc. (JM), PO Box 5108, Denver, CO 80217. (800) 654-3103. Fax: (303) 978-2318.
2. Alternate Manufacturers: Comparable products manufactured by CertainTeed Insulation; Owens Corning Fiberglas; USG; Thermafiber; or accepted equal
3. Substitutions: Section 01 60 00 - Product Requirements: Product Options and Substitutions.
4. Thickness: As shown; where not shown, as required to meet CBC ratings.

## 2.2 INSULATING MATERIALS - GENERAL

A. General: Provide insulating materials that comply with requirements and with referenced standards.
   1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

## 2.3 FORMALDEHYDE-FREE INSULATING MATERIALS

A. Formaldehyde-Free Unfaced Glass-Fiber Batt Insulation: JM Formaldehyde-Free Unfaced Batts; ASTM C665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
   1. Thermal Resistance (R-Value): R-11 and R-19.
   2. Combustion Characteristics: Passes ASTM E136.
   3. Critical Radiant Flux: ASTM E970, greater than 0.11 Btu/sq ft s (0.12 W/cm sq).
   4. Water Vapor Sorption: ASTM C1104, 5 percent or less.
   5. Odor Emission: Passes ASTM C1304.
   6. Corrosiveness: Passes ASTM C665.
   7. Fungi Resistance: Passes ASTM C1338.
   8. Recycled Content: Certified by Scientific Certification Systems to contain minimum of 20 percent post-consumer and 5 percent pre-consumer recycled glass product, on average of manufacturer's products.\
   9. Prove through documentation that product complies with CIWMB Section 01350 for indoor air quality.
   10. Thickness: 3-5/8 inches for R11; and 6-1/2 inches for R-19.

B. Formaldehyde-Free FSK-25 Faced Glass-Fiber Batt Insulation: JM Formaldehyde-Free FSK-25 Faced Batts; ASTM C665, Type III, Class A, Category 1 with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
   1. Thermal Resistance (R-Value): R-11 and R-19.
   2. Combustion Characteristics: Passes ASTM E136.
   3. Critical Radiant Flux: ASTM E970, greater than 0.11 Btu/sq ft s (0.12 W/cm sq).
   4. Water Vapor Permeance: ASTM E96, 0.05 Perms (3 ng/Pa-s $m^2$).
   5. Water Vapor Sorption: ASTM C1104, 5 percent or less.
   6. Odor Emission: Passes ASTM C1304.
   7. Corrosiveness: Passes ASTM C665, 13.8.
   8. Fungi Resistance: Passes ASTM C1338.
   9. Recycled Content: Certified by Scientific Certification Systems to contain minimum of 20 percent post-consumer and 5 percent pre-consumer recycled glass product, on average of manufacturer's products.
   10. Prove through documentation that product complies with CIWMB Section 01350 for indoor air quality.
   11. Thickness: 3-5/8 inches for R11; and 6-1/2 inches for R-19.

## 2.4 ACCESSORIES

A. Safing: USG (800-874-4968) SAFB mineral wool.

B. Nails: 11 gage, barbed, galvanized; 5/8 inch diameter heads.

C. Staples: 7/16 inch steel wire staples.

D. Tape: Self-adhesive vapor retarder tape with flame spread index of 25 or less, smoke developed index of 50 or less.

E. Adhesive: Gemco Tuff Bond Hanger Adhesive.

F. Insulation Fasteners: Steel impale spindle and clip on flat metal base, self adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place. Cemco Insul-Anchors.

G. Wire Mesh: Galvanized steel, hexagonal wire mesh.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

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

### 3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

### 3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Seal joints between closed-cell (non-breathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
   1. Tape ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C. Install glass-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

## 3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

## 3.6 SCHEDULE

A. Interior Wall (Sound) Insulation: R-11 batt, 3-5/8 inch thick, unfaced; and R-19 batt, 6-1/2 inch thick, unfaced. See drawings for location.

B. Exterior Wall (Thermal) Insulation: R19 batt, 6-1/2 inch thick, FSK-25 faced. See drawings for location.

**END OF SECTION**

# SECTION 07 26 00

# CONCETE VAPOR CONTROL BARRIER

## PART 1 – GENERAL

### 1.1 SUMMARY

A. Section includes application of a polymer-resin based (non-silicate) vapor control barrier in areas scheduled to receive floor coverings; and for use as a finished floor sealer.

B. Related Sections:
1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 09 65 00 – Resilient Flooring.
3. Section 09 68 16 – Sheet Carpeting.

### 1.2 REFERENCES

A. American Concrete Institute:
1. ACI 318 – Building Code Requirements for Structural Concrete.

B. ASTM International:
1. ASTM D1308 – Standard Test Method for Effort of Household Chemicals on Clear and Pigmented Organic Finishes.
2. ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
3. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. ASTM F1869 – Standard Test method for Measuring Moisture Vapor Emission Rate of Concrete Subflooring Using Anhydrous Calcium Chloride.

C. Bay Area Air Quality Management District. www.baaqmd.gov

### 1.3 SYSTEM DESCRIPTION

A. Clear penetrating-film forming polymer based, moisture-alkaline barrier for suppressing water vapor emission rates, alkalinity, salt migration and water absorption. Final surface shall maintain a water vapor emission rate of 2.5 pounds/1000 sf/24 hrs ( plus or minus 0.50 pounds) and alkaline resistance of 14 pH for a period of 15 years.
1. Option 1: Apply as a curing, sealing, moisture barrier to freshly poured concrete.
2. Option 2: Application is required to suppress moisture vapor emission rates where testing results exceed flooring tolerances at no cost to Owner.

### 1.4 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Requirements for submittals.

B. Product Data: Physical properties, technical limitations and application requirements.

C. Material Samples: Submit three (3) concrete samples coated one surface and uncoated on opposite surface.

D. Installer: Approved, certified installer certificates.

E. Provide verification of the following:
1. ASTM E 96 - Water Vapor Transmission Reduction.

2. ASTM D 4541 - Concrete Adhesion.
3. ASTM D 1308 - Alkaline, 14pH resistance.
4. VOC content per EPA Method 24.

## 1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section (polymer based moisture-alkaline control barriers) with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum two years experience, approved by manufacturer prior to project start.

## 1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Pre-Installation Meetings.

B. Convene pre-installation meeting a minimum of three weeks prior to commencing work of this section. Testing Agency to participate in the meeting.
   1. Review ASTM F1869, ASTM F710 testing results, building temperature, interior humidity and site conditions. Installer will provide specified vapor-alkalinity control barrier installation procedures and application details.

C. Safety Meeting: Installer shall report ventilation requirements, site protection and material data safety information to disclose product limitations and precautions prior to application. Information is to prevent site contamination and safety issues with other trades.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver Material Safety Data Sheets to site prior to application.

## 1.8 WARRANTY

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. Performance: Application of product shall yield a water vapor emission rate of 2.5 pounds/1000 SF/24 hrs (plus or minus 0.50 pounds) per ASTM F 1869 prior to flooring application. Repair areas above specified requirements at no cost to Owner.
   1. Issuance of warranty shall NOT remove specified performance requirements.

C. Flooring Warranty: In the event moisture vapor emission rates exceed 2.5 pounds/1000 SF/24 hrs (plus or minus 0.50 pounds) and floor covering adhesion is damaged during a period of 15 year period, manufacturer and installer shall repair or replace damaged flooring at no cost to Owner. Repair shall include new barrier materials, floor coverings, adhesives and patching materials.

# PART 2 - PRODUCTS

## 2.1 CONCRETE VAPOR CONTROL BARRIER

A. Manufacturers:
   1. Synthetics Intl; www.SyntheticsIntl.com (866) 646-0356.
      a. Product: Synthetic10.

2. Diamond Stone Products; www.DiamondStoneProducts.com
   a. Project: Vapor Remediation System – VRS.
3. Dex-o-Tex; www.CrossfieldProducts.com
   a. Primer 100.
4. Substitutions: Not permitted.

## 2.2 PHYSICAL PROPERTIES

A. The below methods are to be reported by independent laboratory testing:
1. ASTM E96 - Water Vapor Transmission, wet method: 75-95% vapor reduction
2. ASTM D4541 - Concrete Adhesion: 400-600psi (100% concrete cohesive failure).
3. ASTM D1308 – Chemical Resistance: 14pH solution: 100% Resistant to long term 30 day exposure
4. VOC Content Testing per EPA Method 24: 50 g/liter or less.

B. Site Performance:
1. ASTM F1869 Moisture Reduction.....2.5 lbs. (±0.50).
2. ASTM F710 Alkalinity Resistance.....Resistant to 12.5 -14pH.
3. ASTM D4541 Concrete Adhesion.....100% concrete surface failure.

C. Environmental:
1. Dry to the Touch: 1 hour.
2. Flooring Ready: 24 hours (70 degrees F).
3. Pot Life: 4 hours.
4. Reduction: Water only, up to 5 percent.
5. Clean Up: Water cleanable, no solvents.
6 Cement Patching: Non-pours primer required.
7. Odor: Low odor and no CFC's.
8. VOC Content Testing per EPA Method 24: 50 g/liter or less for primers, sealers and undercoaters.

D. Formulation:
1. Color: Clear, water reduced polymer chemistry.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify conditions are acceptable for a warranted application.

C. Report unacceptable conditions prior to application.

D. New Concrete: Review approved concrete mix design and site conditions prior to application. Notify Architect of unacceptable conditions.

E. Substrates: Slabs where emission rates per ASTM F1869 exceed 3.0 pounds and do not exceed 10 pounds are acceptable for the application of control barrier.

## 3.2 PREPARATION

A. Clean concrete surfaces to allow maximum material penetration in the presence of manufacturer's technical personnel.

B. Vacuum and remove surfaces contamination.

## 3.3 INSTALLATION

A. New Concrete: Apply barrier to clean, absorbent and contaminate free surfaces of newly placed concrete slabs as a replacement for traditional curing methods. No mechanical preparation is required.

B. Substrates: Prepare slabs by the use of a shot blaster or diamond grinding machine to provide a solid, absorbent surface.

C. Apply barrier at a rate of 300 square feet per gallon for a seamless layer, drag with a 3/8 inch nap roller to saturate surface. Allow material penetration for 5 minutes and re-coat surfaces at a rate of 350 square feet per gallon in the opposite direction until saturation in accordance with manufacturer requirements.

D. Allow to cure 1 hour prior to light foot traffic.
   1. Cement patching materials may be installed after 24 hours of cure with the use of a primer for non-porous surfaces.
   2. Apply flooring adhesives after 24 hours of cure.

## 3.4 FIELD QUALITY CONTROL

A. Section 01 45 23 – Testing and Inspection: Inspections and Tests by Manufacturer's Representatives.

B. Protect from damage for 2 hours after application.

C. Perform a minimum of ten (10) concrete moisture vapor emission tests (ASTM F 1869) over barrier surface to verify vapor reduction.
   1. Re-apply barrier in areas where emission rates exceed 2.5 pounds (plus or minus 0.50 pounds).
   2. Apply at a rate to suppress emission rates to compliance.

D. Floor Covering Applications:
   1. Allow barrier to cure for a minimum of 24 hours prior to flooring application.
   2. Cement patching material will require a primer for non-porous surfaces.

E. Report field testing to Architect, Owner and Inspector for approval.

**END OF SECTION**

# SECTION 07 84 00

# FIRESTOPPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes firestopping and through-penetration protection system materials and accessories; and firestopping tops of fire-rated walls.

B. Related Sections
1. Section 07 27 00 – Air Barriers: Air barrier materials to adjacent insulation.
2. Section 09 21 16 – Gypsum Board Assemblies: Gypsum board fireproofing.
4. Section 23 00 00 – Basic HVAC Requirements: HVAC work requiring firestopping.
5. Section 26 00 00 – Basic Electrical Requirements: Electrical work requiring firestopping.

C. Only tested firestop systems shall be used in specific locations as follows:
1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
2. Openings between structurally separate sections of wall or floors.
3. Gaps between the top of walls and ceilings or roof assemblies.
4. Expansion joints in walls and floors.
5. Openings and penetrations in fire-rated partitions or walls containing fire doors.
6. Openings around structural members which penetrate floors or walls.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 – Standard Test Method for Fire Resistive Joint Systems.
5. ASTM E2174 – Standard Practice for On-Site Inspection of Installed Fire Stops.

B. California Building Code: 2007 CBC, Chapter 7.

C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

D. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

E. National Fire Protection Association:
1. NFPA 101 - Life Safety Code.
2. NFPA 70 - National Electric Code.

F. South Coast Air Quality Management District:
1. SCAQMD Rule 1168 – Adhesive and Sealant Applications.

G. Underwriters Laboratories Inc.:

2. UL 263 - Fire Tests of Building Construction and Materials.
3. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
4. UL 1479 - Fire Tests of Through-Penetration Firestops.
5. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
6. UL - Fire Resistance Directory.
   a. Firestop Devices (XHJI).
   b. Fire Resistance Ratings (BXUV).
   c. Through-Penetration Firestop Systems (XHEZ).
   d. Fill, Voids, or Cavity Material (XHHW).
   e. Forming Materials (XHKU).
6. Alternate "Omega Point Laboratories Directory" (updated annually).

## 1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

## 1.4 SUBMITTALS

A. Section 01 32 19 – Submittals: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance and limitation criteria.

C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements and applicable code requirements.

F. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.

G. Submit material safety data sheets provided with product delivered to job-site.

## 1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to CBC for fire resistance ratings and surface burning characteristics.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

C. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through penetration firestop systems are installed per specified requirements.

D. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

E. Through Penetration Firestopping of Fire Rated Assemblies: Firestop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

F. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

G. Fire Resistant Joint Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage (24.0 Pa) minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

H. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

I. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

J. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time).

## 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience, certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

C. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

D. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

E. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

F. Do not use damaged or expired materials.

## 1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 – Product Requirements: Environmental conditions affecting products on site.

B. Do not use materials that contain flammable solvents.

C. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

D. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

E. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

F. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

## PART 2 - PRODUCTS

### 2.1 FIRESTOPPING

A. Manufacturers:
1. Hilti, Inc., Tulsa, Oklahoma; 800-879-8000.
2. A/D Fire Protection Systems, Inc.
3. Dow Corning Corp.
4. 3M Fire Protection Products.
5. General Electric.
6. Specified Technologies.
7. United States Gypsum Company.
8. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

B. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

C. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

D. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

E. Provide products subject to compliance with through penetration firestop systems (XHEZ) and joint systems (XHBN) listed in Volume 2 of the UL Fire Resistance Directory. provide products of the following manufacturers as identified below:

F. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single or Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single or Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

G. Color: As selected from manufacturer's full range of colors.

## 2.2 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:
1. Hilti CP 680 Cast-In Place Firestop Device:
   a. Add Aerator adaptor when used in conjunction with aerator ("sovent") system.
2. Hilti CP 681 Tub Box Kit for use with tub installations.

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant.
2. Hilti CP 604 Self-leveling Firestop Sealant.
3. Hilti CP 620 Fire Foam.
4. Hilti CP 606 Flexible Firestop Sealant.
5. Hilti CP 601s Elastomeric Firestop Sealant.

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
1. Hilti CP 601s Elastomeric Firestop Sealant.
2. Hilti CP 606 Flexible Firestop Sealant.
3. Hilti FS-ONE Intumescent Firestop Sealant.

E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
1. Hilti CP 672 Speed Spray.
2. Hilti CP 601s Elastomeric Firestop Sealant.
3. Hilti CP 606 Flexible Firestop Sealant.
4. Hilti CP 604 Self-leveling Firestop Sealant.

F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.
1. Hilti CP 777 Speed Plugs.
2. Hilti CP 767 Speed Strips.

G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant.

H. Foams, intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant.
2. Hilti CP 618 Firestop Putty Stick.
3. Hilti CP 620 Fire Foam.
4. Hilti CP 601s Elastomeric Firestop Sealant.
5. Hilti CP 606 Flexible Firestop Sealant.

I. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti CP 618 Firestop Putty Stick.

J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
1. Hilti CP 617 Firestop Putty Pad.

K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
1. Hilti CP 642 Firestop Collar.
2. Hilti CP 643 Firestop Collar.
3. Hilti CP 645 Wrap Strips.

L. Materials used for complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti CP 637 Trowelable Firestop Compound.
2. Hilti FS 657 FIRE BLOCK.
3. Hilti CP 620 Fire Foam.

M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti FS 657 FIRE BLOCK.

N. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
1. Hilti CP 672 Speed Spray.
2. Hilti CP 601s Elastomeric Firestop Sealant.
3. Hilti CP 606 Flexible Firestop Sealant.
4. Hilti CP 604 Self-Leveling Firestop Sealant.

O. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

P. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

Q. Acoustical Firestopping: As manufactured by General Electric, "GERTV6428". No known equal.

## 2.3 ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

B. Verify openings are properly sized and in suitable condition for application of firestopping materials.

### 3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, rust, laitance, release agents, water repellents, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing and damming materials to arrest liquid material leakage.

D. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

E. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

F. Do not proceed until unsatisfactory conditions have been corrected.

### 3.3 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

### 3.4 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
   1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
   2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
   3. Protect materials from damage on surfaces subjected to traffic.

### 3.5 FIELD QUALITY CONTROL

A. Section 01 45 23 – Testing and Inspection: Testing and Inspection Services.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

C. All areas of work must be accessible until inspected by the Architect and the Owner's applicable fire protection representative. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification at no additional cost.

D. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174.

E. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

## 3.6 CLEANING

A. Section 01 74 00 - Cleaning: Final cleaning.

B. Clean surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

## 3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

# SECTION 07 90 00

# JOINT PROTECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes sealants and joint backing, and accessories.

B. Related Sections:
1. Section 07 27 00 – Air Barriers: Sealants required in conjunction with air barriers.
2. Section 07 51 00 – Cold Process Roofing: Sealants required in conjunction with roofing.
3. Section 07 84 00 – Firestopping: Firestopping sealants.
4. Section 08 80 00 – Glazing: Glazing sealants and accessories.
5. Section 09 26 00 - Gypsum Board Assemblies: Acoustic sealant.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM C719 - Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement.
2. ASTM C834 - Standard Specification for Solvent Release Type Sealants.
3. ASTM C834 - Standard Specification for Latex Sealing Compounds.
4. ASTM C919 - Practice for Use of Sealants in Acoustical Applications.
5. ASTM C920 - Standard Specification for Elastomeric Joint Sealants
6. ASTM C1083 - Test Method for Water Absorption of Cellular Elastomeric Gaskets and Sealing Materials.
7. ASTM C1193 - Guide for Use of Joint Sealants.
8. ASTM D1056 - Standard Specification for Flexible Cellular materials - Sponge or Expanded Rubber.
9. ASTM D1623 - Test Method for Tensile and Tensile Adhesive Properties of Rigid Cellular Plastics.
10. E84 - Test Method for Surface Burning Characteristics of Building Materials.

### 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

F. Warranty: Include coverage for installed sealants and accessories failing to achieve airtight seal, watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.
   1. Furnish 20 year weatherseal warranty.
   2. Furnish 20 year non-stain warranty for use with sensitive substrates.

## 1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

C. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Acceptance at Site: Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

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

## 1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 – Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

C. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

D. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

## 1.7 COORDINATION

A. Section 01 60 00 – Product Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

C. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

## 1.8 WARRANTIES

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal; watertight seal; exhibit loss of adhesion or cohesion, or do not cure.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALERS

A. Manufacturers:
1. Tremco Incorporated (800) 852-8173.
2. Dow Corning Corp. (800) 248-2481.
3. Henry's Company.
4. Hevi-duty/Nelson (800-331-7325).
5. Lowry. (800-772-2521).
6. Macklanburg Duncan (800-348-3571).
7. Mameco International Inc.
8. Pecora Corp. (800-233-9754).
9. Sika Corp.
10. Specified Technologies, Inc. (800-922-1180).
11. United States Gypsum Co.
12. W.R. Meadows.
13. Substitutions: Section 01630 – Product Options and Substitutions.

B. Compatibility:
1. Provide joint sealants, joint fillers and accessory joint materials that are compatible with one another and with joint substrates under project conditions.
2. Install joint sealants, joint fillers and related joint materials that are nonstaining to visible joint surfaces and surrounding substrate surfaces.

C. Provide colors selected by Architect from manufacturer's standard color range.

### 2.2 ELASTOMERIC SEALANTS

A. Sealant Type A:
1. For exterior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
   a. Control and expansion joints in cast-in-place concrete.
   b. Joints between architectural precast concrete units.
   c. Control and expansion joints in unit masonry.
   d. Butt joints between metal panel.
   e. Joints between marble or granite.
   f. Joints between different materials listed above.
   g. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
   h. Control and expansion joints in ceiling and overhead surfaces.
2. Provide single-component or multi-component, low-modulus, non-sag sealant; comply with ASTM C920, Type S or M, Grade NS, Class 50.
3. Acceptable sealants:
   a. Urethanes:
      1) Single Component:
         a) Dymonic FC.
         b) Vulkem 116.
      2. Multi Component:
         a) Dymeric 240 FC.
         b) Vulkem 227.
   b. Silicones:
      1) Single Component:
         a) Dow Corning 790.

b) Dow Corning 795.
c) Dow Corning 756SMS.
d) Dow Corning 791.
e) Dow Corning CWS and CCS.
f) Spectrem 1.
g) Spectrem 2.
h) Spectrem 3.

B. Sealant Type B:
1. For interior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints on exposed interior surfaces of exterior openings.
   c. Joints on precast beams and planks.
   d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, elevator entrances and similar openings.
   e. Trim or finish joints subject to movement.
2. Acceptable sealants:
   a. Single Component Urethane:
      1) Dymonic FC.
      2) Vulkem 116.
   b. Multi Component Urethane:
      1) Dymeric 240 FC.
      2) Vulkem 227.
   c. Single Component Silicone:
      1) Dow Corning 790.
      2) Dow Corning 795.
      3) Dow Corning CWS, and CCS.
      4) Spectrem 1.
      5) Spectrem 2.
   d. Acrylic Latex:
      1) Tremflex 834.

C. Sealant Type C:
1. For exterior and interior joints in horizontal and sloped traffic surfaces such as, but not limited to:
   a. Control, expansion and isolation joints in cast-in-place concrete.
   b. Control, expansion and isolation joints in structural precast concrete units.
   c. Joints between architectural precast concrete paving units.
   d. Tile control and expansion joints.
   e. Joints between different materials listed above.
2. Provide single-component or multi-component polyurethane sealant having a Shore A hardness of not less than 25 or more than 50 and plus-or-minus 25 percent joint movement capability; comply with ASTM C920, Type S or M, Grade P or NS, Class 25.
3. Acceptable sealants:
   a. THC-900/901.
   b. Vulkem 45 SSL.

D. Sealant Type D:
1. For interior joints in vertical and horizontal surfaces requiring pick-resistant security sealant such as, but not limited to:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints on exposed interior surfaces of exterior openings.

c. Perimeter joints between concrete surfaces and frames of interior doors, windows and elevator entrances.
d. Trim or finish joints subject to minimal movement.

2. Provide a single-component or multi-component, non-sag polyurethane sealant having a Shore A hardness of 55.
3. Acceptable sealants:
   a. Vulkem 617.

E. Sealant Type E:
1. For interior joints in vertical and horizontal surfaces where incidental food contact may occur.
2. Provide single component or multi-component sealant complying United States Department of Agriculture (USDA) guidelines for incidental food contact with the cured sealant; comply with ASTM C920, Type S or M, Grade P or NS, Class 25; select color from listing of those approved.
3. Acceptable Sealants:
   a. Polyurethanes:
      1) Vulkem 116.
      2) Dymonic FC.
   b. Silicones:
      1) Proglaze.
      2) Spectrem 1.
      3). Spectrem 2.
      4). Spectrem 3.

F. Sealant Type F: Not used.

G. Sealant Type G: Not used.

H. Sealant Type H:
1. For interior or exterior joints in vertical surfaces between laps in fabrications of sheet metal.
2. Acceptable products:
   a) Tremco Butyl Sealant.
   b) Tremco Acoustical Sealant.

I. Sealant Type I:
1. For exterior vertical joints under metal thresholds and saddles or as a bedding sealant for sheet metal flashing and frames of metal or wood.
2. Acceptable products:
   a. Polyurethanes:
      1) Vulkem 116.
      2) Dymonic FC.
   b. Silicones:
      1) Dow Corning 790.
      2) Dow Corning 795.
      3) Spectrem 2.
      4) Proglaze.
      5) Spectrem 3.
   c. Other:
      1) Tremco Butyl Sealant.
      2) Tremco Acoustical.

## 2.3 ACOUSTICAL SEALANT

A. General: For use at Sound-Rated Constructions.

B. Acoustical sealant: Non-skinning, non-hardening, flexible sealant specifically designed for sealing gypsum wallboard. Sealant shall be capable of spanning 1/2-inch wide by 3/8-inch deep gaps. Synthetic rubber based products comply with ASTM Standard D-217 and acrylic latex based products comply with ASTM Standard C-834.
   1. Acceptable Products: Tremco (800-321-7906), USG acoustical sealant, Pecora AC-20 FTR (800-233-9754), or approved equivalent.

C. Sheet caulking for junction boxes: "Lowry's Electrical Box Sealer" (800-772-2521), or Tremco sheet caulking (800-321-7906). Sheet caulking for junction boxes at fire-rated assemblies: "Firestop Putty Pads" by Hevi-duty/Nelson (800-331-7325), or Specified Technologies, Inc. (800-992-1180).

D. Backing Rod: Closed-cell, neoprene rod or polyethylene foam.

E. Expanding Foam Sealant: Class 1 fire retardant polycell expanding foam by Macklanburg Duncan (800-348-3571).

F. Cementitious sealant: Spray-applied (40 pcf) Monokote Z-146.

## 2.4 ACCESSORIES

A. Joint cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer for substrates indicated, compatible with joint forming materials.

B. Joint primer: Non-staining type, recommended by sealant manufacturer for substrates, conditions and exposures indicated.

C. Bond breaker: Polyethylene tape or other adhesive faced tape as recommended by sealant manufacturer to prevent sealant contact where it would be detrimental to sealant performance.

D. Joint backer: Polyethylene foam rod or other compatible non-waxing, non-extruding, non-staining resilient material in dimension 25 percent to 50 percent wider than joint width as recommended by sealant manufacturer for conditions and exposures indicated.

E. Masking tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.

## 2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor and approved by the sealant manufacturer as compatible, subject to review of the Architect.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify substrate surfaces and joint openings ready to receive work.

B. Verify joint backing and release tapes are compatible with sealant.

C. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Perform preparation in accordance with ASTM C1193.

B. Protect elements surrounding Work of this section from damage or disfiguration.

C. Prepare surfaces to receive sealants in accord with sealant manufacturer's instructions and recommendations except where more stringent requirements are indicated.

D. Thoroughly clean joint surfaces using cleaners approved by sealant manufacturer whether primers are required or not.
1. Remove all traces of previous sealant and joint backer by mechanical methods, such as by cutting, grinding and wire brushing, in manner not damaging to surrounding surfaces.
2. Remove paints from joint surfaces except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer.
3. Remove wax, oil, grease, dirt film residues, temporary protective coatings and other residues by wiping with cleaner recommended for that purpose. Use clean, white, lint-free cloths and change cloths frequently.
4. Remove dust by blowing clean with oil-free, compressed air.

E. Provide joint backer material uniformly to depth required by sealant manufacturer for proper joint design using a blunt instrument.
1. Fit securely by compressing backer material 25 percent to 50 percent so no displacement occurs during tooling.
2. Avoid stretching or twisting joint backer.

F. Provide bond-breaker where indicated or recommended by sealant manufacturer, adhering strictly to the manufacturers installation requirements.

G. Prime joint substrates where required.
1. Use and apply primer according to sealant manufacturers recommendations.
2. Confine primers to sealant bond surfaces; do not allow spillage or migration onto adjoining surfaces.

H. Taping:
1. Use masking tape where required to prevent sealant or primer contact with adjoining surfaces that would be permanently stained or otherwise damaged by such contact or the cleaning methods required for removal.
2. Apply tape so as not to shift readily and remove tape immediately after tooling without disturbing joint seal.

## 3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   a) Do not leave gaps between ends of joint fillers.
   b) Do not stretch, twist, puncture or tear joint fillers.
   c) Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

1. Use acoustical sealant to form an airtight seal at all penetrations and perimeter of sound-rated partitions, floors and ceilings. Comply with Section 09260 – Gypsum Board Assemblies and ASTM C919. Use backer-rod where gaps to be sealed exceed 3/8-inch.
2. Use sheet caulking to seal the back and sides of all junction boxes (4 gang and smaller) recessed in sound-rated partitions.
3. Apply acoustical sealant as a continuous bead along gypsum board face layer at all head and sill conditions of sound-rated partitions and around the perimeter of resilient ceilings.
4. Apply expanding foam sealant where detailed and where multiple pipes or conduits penetrate sound-rated construction.

F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

## 3.4 CLEANING

A. Section 01 77 00 – Contract Closeout: Final cleaning.

B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

## 3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect sealants until cured.

**END OF SECTION**

# SECTION 08 12 14

# STANDARD STEEL FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes fire-rated and non-rated steel frames.
   1. Provide frames for interior glazed lits.

B. Related Sections:
   1. Section 08 21 00 - Flush Wood Doors.
   2. Section 08 14 33 - Stile and Rail Wood Doors.
   3. Section 08 71 00 - Door Hardware: Hardware, silencers, and weatherstripping.

### 1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   2. ANSI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Doors and Frames.
   3. ANSI A250.11 - Recommended Erection Instructions for Steel Frames.

B. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A924/A924M – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

C. Door and Hardware Institute (DHI):
   1. RL – Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames.
   2. ANSI/DHI A115 Series – Specifications for Steel Doors and Frame Preparation for Hardware.

D. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

E. Steel Door Institute (SDI):
   1. SDI 100 - Recommended Specifications Standard for Steel Doors and Frames.
   2. SDI 105 - Recommended Installation Instructions for Steel Frames
   3. SDI 112 - Galvanized Standard for Steel Doors and Frames.
   4. SDI 117 - Manufacturing Tolerances Standard for Steel Doors and Frames.
   5. SDI 118 - Basic Fire Door Requirements.

F. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.
   2. UL 10C - Positive Pressure Tests of Door Assemblies.

G. Uniform Building Code
   1. UBC Standard 7-2 - Fire Tests of Door Assemblies.

## 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

C. Product Data: Submit frame configuration and finishes.

D. Samples: If specifically requested for specified products; required for alternate products.

E. Manufacturer's Installation Instructions: Submit manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

## 1.4 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Fire Rated Frame Construction at neutral pressure fire tested door frames: Conform to ASTM E152 and UL-10B.

C. Fire Rated Frame Construction at positive pressure fire tested doors: Conform to UBC 7-2 and UL-10C.

D. Fire Rated Frame Construction: Conform to UBC Standard 7-2.

E. Installed Fire Rated Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

F. Attach label from agency approved by authority having jurisdiction to identify each fire rated door frame.
   1. Attach smoke label to smoke and draft control door frames.

## 1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Accept frames on site in manufacturer's packaging. Inspect for damage.

C. Break seal on-site to permit ventilation.

## 1.7 FIELD MEASUREMENTS

A. When verification of field measurements are necessary, verify field measurements prior to fabrication.

## 1.8 COORDINATION

A. Coordinate Work with frame opening construction, door, and hardware installation.

## PART 2 - PRODUCTS

### 2.1 STANDARD STEEL FRAMES

A. Manufacturers:
1. Steelcraft; www.steelcraft.com; Model: MU16 Series Multi-Use Flush Frames.
2. Assa Abloy; Ceco Door Products; Curries; www.assaabloydss.com.
3. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

B. Product Description: Standard shop fabricated steel frames, fire-rated and non-rated types.
1. Exterior Frames:
   a. Level 3 for Door Model 1, nominal 16 gauge/0.053 inch thick material, base metal thickness; 14 gauge/0.067 inch thick material, base metal thickness, for frames over 3'-0" wide.
2. Interior Frames:
   a. Level 2 for Door Model 1, nominal 16 gauge/0.053 inch thick material, base metal thickness.
   b. Level 2 for Door Model 3, nominal 16 gauge/0.053 inch thick material, base metal thickness.

### 2.2 ACCESSORIES

A. Removable Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper proof screws.

B. Bituminous Coating: Non-asbestos fibered asphalt emulsion.

C. Primer: ANSI A250.10 rust inhibitive type.

D. Silencers: Specified in Section 08 71 00. Resilient rubber fitted into drilled hole.

E. Plaster Guards: 26 gauge steel plaster guards or mortar boxes.

F. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

G. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

### 2.3 FABRICATION

A. Fabricate frames as welded unit, for gypsum board slip on type.

B. Construction of MU-Series Flush Frames:
1. Manufacture flush frames from 16 or 14 gauge cold-rolled or galvannealed steel.
2. Fabricate frames with 2 inch faces and double return backbends.
3. Corner Connections: SUA (Set-up and welded), in accordance with ANSI A250.8 (SDI-100). Backweld frames.
4. Reinforce mitered corners with corner clips to provide a firm interlocking of jamb to head. Mitered joints shall be drawn up and secured by screws.
5. Supply frames with factory installed rubber silencers, 3 per strike jamb and 2 per head for pair of doors.
6. Frames for 1-3/4 inch doors shall have 7 gage universal steel hinge reinforcements and prepared for 4-1/2" x 4-1/2" standard or heavy weight template hinges.
7. Strike reinforcements: 16 gage and prepared for an ANSI-A115 1-2 strike.

8. Strike jambs: 14 gage reinforcement and prepared for cylindrical ANSI-AI 15.3 strikes.
9. Provide metal plaster guards for mortised cutouts.
10. Reinforcements for surface closer: 14 gage steel.
11. Galvannealed frames shall have galvannealed hardware reinforcements.
12 Provide adequate reinforcements for other hardware when required.
13. Furnish frames with a minimum of six wall anchors and two base anchors of manufacturer's standard design.

C. Construction of Architectural Stick Systems:
1. Fabricate Architectural stick frame assemblies of standard frame components, manufactured from 16 gage galvannealed steel.
2. Where sticks are used at door openings and frame assemblies, prepare for hardware as specified.
3. Fabricate frame assemblies from three basic components:
   a. Open sections: (Perimeter members).
   b. Closed sections: (Intermediate members.)
   c. Sill sections.
4. Open sections: Identical in configuration to Steelcraft standard frames.
5. Closed sections: Identical jamb depths, face dimensions and stops as the open sections.
6. Closed sections: Full length internal reinforcement of 16 gage steel, spot welded to both soffits at 8 inches on center.
7. Sill Sections: Either flush with both faces of adjacent vertical members or recessed from one face of the adjacent vertical members.
8. Cut individual components to length and notch to assure square joints and corners.
9. Weld joints and corners of frame assembly and grind smooth at face of sections.
10. Ship frame assemblies to job site completely welded. Field joints permitted only when size of total assembly exceeds shipping limitations.
11. When frame assemblies are subjected to windloads, fabricate vertical members free of field splices.
12. Provide steel channel glazing beads with assemblies for all areas in which glazing will be installed.
13. Provide all necessary anchors for jambs, heads, and sills of assemblies.

D. Mullions for Double Doors: Removable type, specified in Section 08710 – Door Hardware.

E. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.

F. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.

G. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

H. Prepare frames for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.

I. Attach fire rated label to each fire rated frame.

J. Weld plaster guards to back of finish hardware cutouts where mortar or other materials might obstruct hardware operation.

## 2.4 SHOP FINISHING

A. Steel Sheet:
   1. Exterior Locations: Hot-dipped galvannealed steel, A60 zinc-iron alloy coating conforming to ASTM A924.
   2. Interior Locations: CRS (Cold rolled steel) conforming to ASTM A653; or galvannealed steel per Paragraph 2.4.A.1.

B. Surface Preparation (Factory Pretreatment): Thoroughly wash, de-grease, clean and treat with phosphatized process.

C. Primer: One coat of baked-on, rust-inhibiting primer in accordance with ANSI A250.10.

D. Coat inside of frame profile with bituminous coating to minimum thickness of 1/16 inch for protection of steel frame from corrosion when in contact with masonry.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify opening sizes and tolerances are acceptable.

## 3.2 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

B. Coat inside of frames with bituminous coating to a thickness of 1/16 inch.

## 3.3 INSTALLATION

A. Install frames in accordance with ANSI A250.8, SDI 105, and ANSI/DHI A115-IG.
   1. Install fire rated frames in accordance with NFPA Pamphlet 80.

B. Anchors:
   1. Jambs:
      a. General: Position one (1) anchor above top butt reinforcement and one (1) anchor below bottom butt reinforcement; minimum of four (4) anchors per door jamb, 24 inches on center maximum.
      b. Frames set in Metal Stud Partitions: Lock-in 18 gauge steel jamb anchors, designed to be attached to webbing of the closed steel studs which are built around the frame. Adjustable base anchors are attached directly to the floor and adjusted.
   2. Head: Provide minimum of two (2) anchors at frames over 2'-6" wide; 24 inches on center, maximum.

C. Coordinate frame anchor placement with wall construction type (cement plaster, masonry, gypsum board, concrete, etc.)

D. Metal Frames:
   1. General: Set frames plumb, straight and square; align and securely brace until permanent anchors are set; use shims where required. Remove temporary braces after wall construction is completed.

2. Door Frames: Where shown, provide overhead frame bracing; securely anchor to structure. Install roll-formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
3. Grouted Frames: In sound rated partitions, grout entire door frames solid with plaster or appropriate grouting material.
4. Glazed Frames: Attach frames to structure to withstand 24 lbs. per square foot wind load normal to glass surface. Coordinate installation of glazing per Section 08 80 00 – Glazing.
5. Sealant: Seal perimeter of frames and adjoining material per Section 07 90 00 – Joint Protection.

E. Coordinate installation of frames with glazing specified in Section 08 80 00.

F. Coordinate installation of frames with hardware specified in Section 08 71 00.

G. Coordinate installation of frames with wood doors specified in Section 08 14 16 and Section 08 14 33.

H. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

I. Touch up damaged factory finishes.

## 3.4 ERECTION TOLERANCES

A. Clearance Between Door and Frame: As specified in ANSI A250.8.

B. Maximum Diagonal Distortion: 1/8 inch measured with straight edges, crossed corner to corner.

**END OF SECTION**

# SECTION 08 14 16

# FLUSH WOOD DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes flush wood doors, flush configuration, fire rated and non-rated.

B. Related Sections:
1. Section 08 12 14 - Standard Steel Frames.
2. Section 08 71 00 - Door Hardware.
3. Section 08 80 00 – Glazing.

### 1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A135.4 - Basic Hardboard.
2. ANSI A115. W Series – Wood Door Hardware Standards.
3. ANSI A208.1 – Particleboard.
4. ANSI / WDMA I.S. 1-A-04 Industry Standard for Flush Wood Doors.

B. ASTM International:
1. ASTM E-90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
2. ASTM E152 – Methods of Fire Tests for Wood Doors.
3. ASTM E336 – Standard Test Method for Measurement of Airborne Sound Insulation at Buildings.
4. ASTM E413 - Standard Classification for Rating Sound Insulation.

C. Architectural Woodwork Institute:
1. AWI - Quality Standards Illustrated, Section 1300.

D. Hardwood Plywood and Veneer Association:
1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

F. National Electrical Manufacturers Association:
1. NEMA LD 3 - High Pressure Decorative Laminates.

G. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

H. Underwriters Laboratories Inc.:
1. UL - Building Materials Directory.
2. UL 10B - Fire Tests of Door Assemblies. – Neutral Pressure.
3. UL 10C – Fire Tests of Door Assemblies – Positive Pressure.
4. UL - Building Materials Directory.

I. Uniform Building Code:
1. UBC Standard 7-2 - Fire Tests of Door Assemblies.

J. Window and Door Manufacturers Association:
   1. WDMA Finish System TR-6, Transparent or OP-6, Ppaque – Catalized Polyurethane.
   2. WDMA I.S. 1-A – Architectural Wood Flush Doors.

K. Woodwork Institute:
   1. WI – Manual of Millwork, Section 12 – Architectural Flush Wood Doors.

## 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special blocking for hardware, factory machining criteria, identify cutouts for glazing.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate doors to be factory finished and finish requirements where scheduled.
   4. Indicate fire ratings for doors.

C. Indicate compliance with Positive Pressure.

D. Product Data: Submit information on door core materials and construction, and on veneer species type and characteristics, including WDMA I.S.10A and AWI classifications. See WDMA "A Specifier's Guide to Door Face Veneers" for cut and matching requirements, factory machining and factory finishing criteria.

E. Samples:
   1. Submit two samples of door construction, 8 inch by 8 inch in size cut from bottom corner of door.
   2. Submit two samples of door veneer 8 inch by 8 inch in size, illustrating wood grain, stain color, and sheen.

F. Manufacturer's Installation Instructions: Submit special installation instructions.

G. Manufacturer's Certification: Submit manufacturer's certification that doors comply with specified requirements and are suitable for intended application.

H. Manufacturer's full lifetime warranty.

## 1.4 QUALITY ASSURANCE

A. Source limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Flush wood doors shall conform to the latest edition of the WDMA I.S. 1-A requirements for "Premium Grade" and/or AWI Version 7 Custom Grade and WI Custom Grade.

C. Finish doors in accordance with AWI Quality Standard Section 1500, Custom Grade.

D. Perform Work in accordance with AWI Quality Standard Section 1300, Custom Grade.

E. Tolerances for Warp, Telegraphing, Squareness, and Prefitting Dimensions: WDMA I.S. 1-A.

F. Identifying Label:

1. Door manufacturer.
2. Order number.
3. Door number.
4. Fire rating, if applicable.

G. Fire Rated Door Construction: Labeled by Intertek Testing Services/Warnock Hersey (ITS-WH):
1. Construction Details and Hardware Application: Approved by labeling agency.

H. Fire Rated Door Construction: Conform to one of the following for positive pressure fire tested doors:
1. NFPA 252, with neutral pressure level at 40 inches (maximum above sill at 5 minutes into test.
2. UL 10C.
3. 20-Minute Fire Rated Corridor Doors: Fire tested without hose stream test.

I. Positive Pressure Opening Assemblies: UBC 7-2-1997/UL 10C.

J. Fire-rated Door Construction: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UBC 7-2-1997 (Positive Pressure).

K. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

L. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.
1. Attach smoke label to smoke and draft control doors.

M. Environmental Responsibility: Provide doors manufactured with the following environmentally responsible core materials:
1. Particleboard Core: Scientific Certification Systems (SCS) certified.

## 1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Deliver, store, protect and handle products under provisions of WDMA, AWI, WI and manufacturer's care and handling instructions.
1. Deliver doors to site in manufacturer's original, unopened containers and packaging , with labels clearly identifying product name and manufacturer.
2. Package doors individually in polybags.

C. Storage:
1. Store doors in accordance with manufacturer's instructions.
2. Store doors in clean, dry area indoors, protected from damage and direct sunlight.
3. Store doors flat on level surface.
4. Do not store doors directly on concrete.
5. Keep doors completely covered. Use covering which allows air circulation and does not permit light to penetrate.
6. Store doors between 50 and 90 degrees F and 25 to 55 percent relative humidity.

D. Handling:
   1. Handle doors in accordance with manufacturer's instructions.
   2. Protect doors and finish during handling and installation to prevent damage.
   3. Handle doors with clean hands or clean gloves.
   4. Lift and carry doors. Do not drag doors across other doors or surfaces.

E. Certain wood species are light sensitive. Protect doors from exposure to natural and artificial light after delivery.

## 1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not subject doors to extreme conditions or changes in heat, dryness, or humidity in accordance with the latest edition of WDMA I.S. 1-A.

## 1.8 COORDINATION

A. Coordinate Work with door opening construction, door frame and door hardware installation with a pre-installation conference.

## 1.9 WARRANTY

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. Warrant solid core, interior doors for life of installation against warpage, delamination, and defects in materials and workmanship.

C. Defects noted during warranty period shall be corrected at no cost to Owner. Corrective work shall include labor and material for repair, replacement, refinishing, and rehanging as required.

# PART 2 - PRODUCTS

## 2.1 FLUSH WOOD DOORS

A. Manufacturers:
   1. VT Industries, Inc., www.vtindustries.com
   2. Marshfield Door Systems™; www.marshfielddoors.com.
   3. Algoma Hardwoods Inc.; www.algomahardwoods.com
   4. Eggers Industries; www.eggersindustries.com
   5. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

B. Product Description: Solid core flush wood doors, wood veneer facing material, fire rated and non-rated types; flush and flush glazed design, factory pre-fit, shop finished wood doors.
   1. Flush Interior Doors: 1-3/4 inches thick; solid core 5-ply hot press construction; fire-rated, and non-fire rated, where indicated on Drawings.

## 2.2 5-PLY FLUSH BONDED PARTICLE-CORE DOORS

A. 5-Ply Flush Bonded Particle-Core Doors:
   1. Model: 5502-2, particleboard core, non-rated and 20-minute rated.
   2. Compliance: WDMA I.S.1-A.
      a. Quality Grade: Premium grade, extra heavy duty.
      b. Type: PC-5ME.

3. 7-Ply and Non-Bonded Core Construction: Not acceptable.
4. Door Thickness: 1-3/4 inches.
5. Stiles:
   b. Inner Stiles: 1-3/8 inches wide, before prefitting.
   c. Structural Composite Lumber (SCL) With Outer Stile: Same species as face veneer.
   d. Outer Stile: Apply after beveling and before face application.
6. Rails:
   a. Structual composite lumber (SCL).
   b. Minimum Width Before Prefitting: 1-3/8 inches.
7. Core:
   a. Material: Particleboard.
   b. Particleboard Compliance: ANSI A208.1, Grade 1-LD-2.
8. Door Assembly:
   a. Glue stiles and rails to core.
   b. Sand entire assembly flat as a unit to ensure minimal telegraphing of core components through face veneers.
9. Composite Crossbands:
   a. Apply to core before application of matching hardware stiles.
   b. Exposed Crossbanding: Not allowed along stile edges.
10. Veneers:
   a. Apply to crossbanded core in hot press using Type I, exterior, water-resistant adhesive.
   b. 5-ply construction.
11. Face Veneers:
   a. Veneer Species: "Select White" Birch, or "Select White" Maple; as approved by Owner.
   b. Veneer Cut: Plain sliced.
   c. Veneer Match: Slip match running.
   d. Veneer Grade: Custom.
   e. Minimum Thickness Before Sanding: 1/42 inch.

## 2.3 FLUSH FIRE-RATED WOOD DOORS

A. Flush Fire-Rated Wood Doors:
1. Model: 5511-2, 90-minute rated.
2. Compliance: WDMA I.S.1-A.
   a. Quality Grade: Premium.
   b. Type: FD-5.
3. Door Thickness: 1-3/4 inches.
4. Outer Stiles: Same species as face veneer.
5. Inner Stiles:
   a. Noncombustible material, 90-minute rated.
   b. Warranted for use with standard-weight mortise butt hinges and No. 12, 1-1/4-inch steel threaded-to-head screws.
6. Rails:
   a. Noncombustible material, 90-minute rated.
   b. Width: Manufacturer's standard width.
7. Core:
   a. Non-combustible mineral board.
   b. Weight: 30.8 pcf to 34.7 pcf.
   c. Does not contain asbestos or added urea formaldehyde.
8. Composite Crossbands:
   a. High Density Fiber (HDF); apply to core before application of matching hardware stiles.
   b. Exposed Crossbanding: Not allowed along stile edges.
9. Face Veneers:

a. Veneer Species: "Select White" Birch or "Select White" Maple, as approved by Owner.
b. Veneer Cut: Plain sliced.
c. Veneer Match: Slip match running.
d. Veneer Grade: Custom.
e. Minimum Thickness Before Sanding: 1/42 inch.

10. Positive Pressure:
a. Where UBC 7-2-1997/UL 10C standards for positive pressure apply, doors shall be constructed in accordance with Category A guidelines as published by Intertek/Warnock Hersey.
b. Smoke Gasketing: Apply smoke gasketing around frame perimeter to meet S-rating.
c. Intertek/Warnock Hersey Category B Guidelines: Edge sealing systems not allowed on frames.

## 2.4 FABRICATION

A. Fabricate doors in accordance with WDMA I.S.1-A and AWI Section 1300 Quality Standards requirements.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
1. WDMA prefit clearances for factory fit doors.
2. NFPA 80 for fire rated doors.
3. Manufacturer's hardware templates.

C. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, and hardware templates.
1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

D. Fabricate fire rated doors in accordance with WDMA I.S.1 and to Warnock Hersey requirements. Attach fire rating label to door edge.

E. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement, if required by manufacturer for warranty coverage. Supply innerblocking for all surface applied hardware for 45, 60 and 90 minute mineral-core fire rated doors. Through bolts not accepted.

F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts.

G. Factory seal top and bottom rails of doors before shipping, if required by manufacturer for warranty coverage.

H. Provide edge clearances in accordance with AWI 1300.

I. Factory fit doors for frame opening dimensions identified on shop drawings.

J. Prefit tolerances shall be in accordance with the requirements of WDMA I.S. 1-A and AWI Section 1300, latest editions.

K. Apply appropriate labels.

## 2.5 FACTORY FINISH

A. Doors shall receive factory finishing.

B. Factory Finishing: WDMA System TR-6, catalyzed polyurethane, premium grade. WDMA finish Types 2 and 3 are not acceptable.
1. Stain coat.
2. Sealer: 3 coats.
3. Sanding: 320-grit sandpaper.
4. Topcoat: 2 coats.

C. Stain Color: Medium tone Honey Birch, or Honey toned Maple, as approved by Owner.

D. Top and Bottom Rails: Factory sealed with wood sealer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine locations to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.

B. Ensure frames are solidly anchored, allowing no deflection when doors are installed.

C. Ensure frames are plumb, level, square, and within tolerance.

### 3.2 PREPARATION

A. Allow doors to become acclimated to building temperature and humidity before installation.

### 3.3 INSTALLATION

A. General: Install doors to comply with manufacturer's written instructions, referenced quality standards, and as indicated.

B. Install fire rated and non-rated doors in accordance with AWI Quality Standard, NFPA 80, and to requirements for fire rating label by UL or Intertek Testing Services (Warnock Hersey Listed).

C. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

D. Do not trim Positive Pressure Rated Doors for width.

E. Machine cut doors for hardware installation.

F. Coordinate installation of doors with installation of frames specified in Section 08 12 14 and hardware specified in Section 08 71 00.

G. Pilot drill screw and bolt holes using templates provided by hardware manufacturer.

H. Exercise caution when drilling pilot holes and installing hinges so that pilot holes are not over-drilled and screws are not over-torqued. Follow manufacturer's installation instructions for positive pressure doors.

## 3.4 INSTALLATION TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for maximum diagonal distortion.

C. Conform to WDMA standards and testing methods for warp, cup, bow and telegraphing.

## 3.5 ADJUSTING

A. Adjust doors to swing freely, without binding in frame.

B. Adjust hardware to operate properly.

C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

D. Remove and replace damaged doors that cannot be successfully repaired, as determined by Architect.

## 3.6 CLEANING

A. Section 01 74 00 – Cleaning: Requirements for cleaning.

B. Clean doors promptly after installation in accordance with manufacturer's instructions.

C. Do not use harsh cleaning materials or methods that could damage finish.

## 3.7 PROTECTION

A. Protect installed doors from damage during construction.

B. Place polybags over doors after adjusting and cleaning.

**END OF SECTION**

# SECTION 08 31 13

# ACCESS DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes fire resistive rated and non-rated access doors and panels with frames.
   1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.
   2. Coordinate exact locations with various trades to assure proper placement of access doors and panels.

B. Related Sections:
   1. Section 09 90 00 - Painting and Coating: Field paint finish.
   2. Section 09 26 00 - Gypsum Board Assemblies.
   3. Section 23 00 00 - Basic HVAC Requirements: Access doors in ductwork.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Intertek Testing Services (Warnock Hersey Listed)::
   1. WH – Certification Listings.

C. National Fire Protection Association:
   1. NFPA 80 – Standard for Fire Doors, Fire Windows.

D. UL - Underwriters' Laboratories, Inc.:
   1. UL – Building Materials Directory.

### 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate exact position of access door units. Refer to Divisions 23 and 26 regarding requirements for showing locations of access doors provided under those Divisions.

C. Product Data: Submit literature indicating sizes, types, finishes, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.

D. Samples: Submit two 12 x 12 inch in size illustrating frame configuration and anchors.

E. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

### 1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Contract Closeout: Closeout procedures.

B. Project Record Documents: Record actual locations of access units.

## 1.5 QUALITY ASSURANCE

A. Fire Resistance Ratings: Where indicated as fire rated provide assemblies from manufacturers listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.

B. Attach label from agency approved by authority having jurisdiction to identify each fire rated access door.

## 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified with minimum three years documented experience.

## 1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Packaging and Shipping: Identify type and size of each door.

C. Storage and Protection:
   1. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.
   2. Deliver products only after proper facilities are available; handle carefully to prevent damage and store on clean concrete surface or raised platform in safe, dry area.

## 1.8 COORDINATION

A. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

# PART 2 - PRODUCTS

## 2.1 ACCESS DOORS AND PANELS

A. Manufacturers:
   1. J.L. Industries.; www.jlindustries.com
   2. Milcor LTD, Partnership.; www.milcorinc.com
   3. Nystrom Products Co.; www.nystrom.com
   4. Karp Associates, Inc.; www.karp.com
   5. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

## 2.2 MATERIALS

A. Non-Fire Rated:
   1. Type 1: Flush steel door and flanged frame for gypsum board walls and ceiling installations.
      a. Manufacturer: Milcor, Inc., "Model DW"; Karp Associates, Inc., "DSC-214M", or equal.

B. Fire Rated:
   1. Type A: Fire-resistive steel door with recess to receive gypsum board and flanged frame for rated suspended gypsum board ceiling installations.
      a. Manufacturer:

1) JL Industries, Model "FD".
2) Milcor, Inc. Model "ATR".
3) Karp Associates, Inc., Model "KATR".
4) Or equal.

2. Type B: Fire rated flush steel door and flanged frame, UL 1-1/2 hour rated, self latching with direct action knurled knob, for installation in rated walls.
   a. Manufacturer:
      1) JL Industries, Model "FDWB".
      2) Milcor, Inc., Model "Fire-Rated Access Door"
      3) Karp Associates, Inc., Model "KRP-250FR"
      4) Or equal.

## 2.3 ACCESSORIES

A. Smoke Seal: Pemko S-88 smoke seal.

B. Acoustical Sealant: As specified in Section 07 90 00 – Joint Protection.

## 2.4 FABRICATION

A. Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.

B. Wall and Ceiling Access Door and Panel Hardware:
   1. Hinge: Standard continuous or concealed spring pin type, 175 degree steel hinges.
   2. Lock: Screw driver slot for quarter turn cam lock.

C. Size Variations: Obtain acceptance of manufacturer's standard size units which vary slightly from sizes shown or scheduled.

## 2.5 SHOP FINISHING

A. Base Metal Protection: Prime coat units with baked-on rust-inhibitive zinc dust primer.

B. Access Doors at ceramic tile surfaces: Stainless Steel; No. 4 finish.

C. Finish Painting: As specified in Section 09 90 00 – Painting and Coating.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify rough openings for access doors and panels are correctly sized and located.

B. Do not install access doors and panels until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Coordinate details with other work supporting, adjoining or requiring access doors.

B. Verify that location will serve portion of work to which access is required.

## 3.3 INSTALLATION

A. General: Install access doors in accordance with manufacturer's instructions and at locations authorized by the Architect in accordance with requirements for work of Divisions 22 and 23.

B. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.
   1. Set concealed frame type units flush with adjacent finished surfaces.

C. Position unit to provide convenient access to concealed work requiring access.

D. Install fire rated units in accordance with NFPA 80 and requirements for fire listing.

E. Provide fire-rated access doors at sound-rated construction. Seal door flanges with specified smoke seal. Seal entire assembly to gypsum board with acoustical sealant.

## 3.4 ADJUSTING AND CLEANING

A. Thoroughly clean surfaces of grease, oil, or other impurities, touch-up abraded prime coat, and otherwise prepare for finish painting where required.

**END OF SECTION**

# SECTION 08 41 13

# ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Architectural Aluminum Storefront Systems, including swing doors, project-out windows, perimeter trims, stools, accessories, window installation hardware and accessories, shims and anchors, and perimeter sealing of storefront units.

B. Related Sections:
1. Section 07 27 00 - Air Barriers: Air barrier between glazed wall systems and adjacent construction
2. Section 07 84 00 - Fire Stopping.
3. Section 07 90 00 - Joint Protection: Joint sealants installed as part of aluminum entrance and storefront systems
4. Section 08 71 00 - Door Hardware.
5. Section 08 80 00 - Glazing.

### 1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z97.1 – Safety Glazing Materials used in Buildings Safety.

B. American Architectural Manufacturers Association:
1. AAMA 503 - Voluntary Specification for Field Testing of Metal Storefronts. Curtain Wall and Sloped Glazing Systems.
2. AAMA 505 –
3. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
5. AAMA CW-10 – Care and Handling of Architectural Aluminum From Shop to Site.

C. ASTM International:
1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
3. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
4. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
5. ASTM E783 – Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
6. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.

D. Glass Association of North America:
1. GANA – Glazing Manual.

E. National Fenestration Rating Council Incorporated:
1. FRC 100 - Procedures for Determining Fenestration Product U-Factors.

## 1.3 PERFORMANCE REQUIREMENTS

A. Wind loads: Provide framing system; include anchorage, capable of withstanding wind load design pressures of 20 lbs./sq. ft. inward and 20 lbs./sq. ft. outward. The design pressures are based on the CBC Building Code; 2007 Edition.

B. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft$^2$ at a static air pressure differential of 6.24 psf.

C. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf as defined in AAMA 501.

D. Uniform Load: A static air design load of 20 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

E. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
1. Glass to Exterior: 0.47 (low-e) BTU/hr/ft$^2$/°F.
2. Glass to Center: 0.44 (low-e) or 0.61 (clear) BTU/hr/ft$^2$/°F.
3. Glass to Interior: 0.56 (clear) BTU/hr/ft$^2$/°F.

F. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
1. Glass to Exterior: $70_{frame}$ and $69_{glass}$ (low-e).
2. Glass to Center: $62_{frame}$ and $68_{glass}$ (low-e) or $63_{frame}$ and $56_{glass}$ (clear).
3. Glass to Interior: $54_{frame}$ and $58_{glass}$ (clear).

## 1.4 PERFORMANCE REQUIREMENTS – PROJECT-OUT WINDOW

A. Windows shall be Architectural Aluminum Project Out windows in accordance with ANSI/AAMA/NWWDA 101/I.S.2-97 or NAFS-1 Voluntary Specifications for Aluminum and Poly Prime Windows and Glass Doors for a Class and Grade of P-HC40 – P-HC70 for Project Out Windows.

B. Test Units:
1. Conform to minimum size in accordance with ANSI/AAMA/NWWDA 101/I.S.2-97 or NAFS-1 for each test unit sizes and configurations.
2. Units submitted for laboratory testing shall be manufacturer's standard construction, glazed and assembled in accordance with manufacturer's specifications and ANSI/AAMA/NWWDA 101/I.S.2-97 or NAFS-1

C. Window Performance Requirements:
1. Air Infiltration:
   a. Project Out windows: When closed and locked, the test specimen shall be tested in accordance with ASTM E 283 at a minimum frame size of 60 inches x 36 inches Air infiltration rate shall not exceed 0.06 cfm/ft of sash perimeter at a static air pressure differential of 6.24 psf.
2. Water Resistance:
   a. Project Out Windows: When closed and locked, the test specimen shall be tested in accordance with ASTM E 547 and ASTM E 331 at a

minimum frame size of 60 inches x 36 inches. There shall be no leakage as defined in test method at a static air pressure differential of 12 psf.

3. Uniform Design Load: When closed and locked, a minimum static air pressure difference of 40 psf and 70 psf shall be applied in the positive and negative direction in accordance with ASTM E 330.
4. Uniform Load Structural Test:
   a. Project Out Windows: When closed and locked, a minimum static air pressure difference of 60 psf and 105 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. (1.5 x Design Load).
5. Thermal Transmittance (Conductive U-factor):
   a. Project Out Windows: When tested to AAMA Specification 1503, the conductive thermal transmittance (U-factor) shall not be more than 0.68 BTU/hr/ft$^2$/°F. (NFRC – 0.62)
6. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than Frame 51, Glass 54. or Condensation Index (I): when tested to CSA-A440-00, the condensation index shall not be less than Frame 47, Glass 48.
7. Forced Entry Resistance: Windows shall conform to ASTM F588, Performance Level 10, or AAMA 1302.5.

## 1.5 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related Work; and installation requirements.

C. Product Data: Submit component dimensions, anchorage and fasteners, glass, internal drainage, and typical details.

D. Samples: Submit two 12 by 12 inches in size illustrating window frame section, factory finished aluminum surfaces, and glazing materials illustrating edge and corner.

E. Test Reports: Submit certified test reports by independent third party such as AAMA, CAWM, or NFRC showing compliance with specified performance characteristics.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Installation Data: Special installation requirements.

## 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 10 years documented experience, capable of providing field service representation during construction, approving acceptable installer and approving application method.

B. Installer: Company experienced in performing Work of this section with minimum three years documented experience, acceptable to manufacturer.

## 1.7 REGULATORY REQUIREMENTS

A. The aluminum-framed entrances and storefronts system requires Deferred Approval from Division of the State Architect.

B. Fabrication of the aluminum-framed entrances and storefronts system shall not be started until Contractor's Deferred Approval Submittal, including Shop Drawings, Specifications, and Engineering Calculations for the actual system to be installed have been accepted and signed by the Architect or Structural Engineer and approved by DSA.

## 1.8 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Pre-installation meeting.

B. Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

C. Convene minimum one week prior to commencing work of this section.

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting and handling products.

B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Packing, Shipping, Handling and Unloading: Handle products of this section in accordance with AAMA CW-10. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage: Store materials protected from exposure to harmful weather conditions. Handle framing material and components to avoid damage.

E. Protection: Protect framing material against damage from elements, construction activities, and other hazards before, during and after framing installation.

## 1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

## 1.11 WARRANTY

A. Section 01700 – Execution Requirements: Requirements for warranties.

B. Manufacturer's Product Warranty: Submit, for Owner's acceptance, manufacturer's warranty for entrance system as follows:

1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by Kawneer. In addition, welded door corner construction shall be supported with a limited lifetime warranty for the life of the door under normal use.

C. Provide 5 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 5 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## PART 2 - PRODUCTS

### 2.1 METAL FRAMED STOREFRONTS

A. Manufacturers:
1. Kawneer Company, Inc., www.kawneer.com; 555 Guthridge Court, Technology Park/Atlanta, Norcross, GA 30092; Telephone: 770 449 5555; Fax: 770 734 1560.
2. EFCO Corp. www.efcocorp.com.
3. United States Aluminum Corp; www.usalum.com.
4. Substitutions: Section 01 60 00 - Product Options and Substitutions.

B. Product Description and Basis of Design: Kawneer Aluminum Storefront Systems.
1. Series: Trifab® VG 451T (thermal) Framing System.
2. Framing Member Profile: 2-inch x 4-1/2 inch nominal dimension; Front, Inside Glazed, Structural Silicone or Weatherseal Glazed (Type B); Shear Block.
3. Finish/Color: (See Article 2.5 Shop Finishing).

C. Product Description and Basis of Design: Kawneer Aluminum Entrances.
1. 500 Swing door; wide stile, 5" vertical face dimension, 1-3/4" depth, high traffic applications.
2. Finish/Color: (See Article 2.5 Finishes)

D. Product Description and Basis of Design: Kawneer Sealair® Heavy Commercial Architectural Aluminum Windows.
1. Storefront GLASSvent, Thermal (Structural Silicone Glazed), 2-3/4" Deep Frame, Project-Out, for installation into Kawneer Storefront System. P-HC40.

### 2.2 COMPONENTS

A. Aluminum (Framing and Components):
1. Material Standard: ASTM B 221; 6063-T6 alloy and temper
2. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.
3. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

B. Aluminum Entrances and Components:
1. Material Standard: ASTM B 221; 6063-T6 alloy and temper.
2. Door stile and rail face dimensions of the 500 Entrance Door as follows:
   a. Vertical Stile: 5 inches.
   b. Top Rail: 5 inches.
   c. Bottom Rail: 10 inches.
3. Major portions of the door members to be 0.125 inch nominal in thickness and glazing molding to be 0.05 inch thick.
4. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by The Aluminum Association.
5. Glazing gaskets: Either EPDM elastomeric extrusions or a thermoplastic elastomer.
6. Provide adjustable glass jacks to help center the glass in the door opening.

C. Project-Out Awning Window:
1. Product: Kawneer Sealair® Heavy Commercial Architectural Aluminum Windows. Series: Storefront GLASSvent™, project-out awning window.
   a. Framing Member Profile: 2-3/4 inch for 1-inch glass.
   b. Grade Designation: P-HC40 for Project Out Windows.

c. Finish: As specified under Article 2.5.

2. Materials: Aluminum Windows and Components:
   a. Material Standard: ASTM B221, G.S. 10A-T5; 6063-T5 alloy and temper.
   b. Total Frame Depth: Not less than 2-3/4 inches (1-inch glass).
   c. Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements.
   d. Frame and ventilator corner construction: Consists of a mitered corner joint with an internal clip, sealed and mechanically staked.
   e. Frame shall have a continuous primary weather seal of polyethylene clad urethane foam, the rainscreen weather stripping shall be dual durometer Santoprene. Each corner shall be neatly mitered.
   f. Factory fabricate and assemble frames and ventilators.
3. Accessories:
   a. Fasteners: Where exposed, shall be 300 Series, Stainless Steel.
   b. Standard Hardware:
      1) Cast White Bronze Cam Locking Handles.
      2) Stainless Steel 4-Bar Hinges.
   c. Insect Screens: Extruded aluminum frames, 6063-T5 alloy and temper, joined at corners; 18 x 16 mesh aluminum screen cloth; frames finished to match aluminum windows; splines shall be extruded vinyl, removable to permit rescreening, individual standard wickets.
4. Glass and Glazing:
   1. General: Glass thickness and type shall be in accordance with manufacturer's recommendations for prescribed design pressure. Factory glazing shall be in accordance with manufacturer's standard requirements.
      a. Material Compatibility: Glazing materials shall be of material compatible with aluminum and those sealants and sealing materials used in the composite structure. Interior glazing tape shall be a foam-type tape installed per the manufacturer's instructions.
      b. Manufacturer's Standards: The structural seal and weather seal shall be silicone applied and cured per the silicone manufacturer's instructions.
      c. For insulating glass, secondary seal shall be silcone sealant and be designed for 4-sided silicone applications.
   B. Glass Materials:
      1. Insulating Low-E Glass Units as specified in Section 08 80 00 – Glazing.

D. Sealants: Refer to Section 07 90 00 – Joint Protection.

E. Glass: Refer to Section 08 80 00 – Glazing.

## 2.3 ACCESSORIES

A. Fasteners: Where exposed, shall be Stainless Steel.

B. Glazing gaskets: Extruded EPDM rubber.

C. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Thermal Barrier (Trifab® VG 451T):
   1. Kawneer IsoLock® Thermal Break with a 1/4 inch separation consisting of a two part chemically curing, high density polyurethane which is mechanically and adhesively joined to aluminum storefront sections.

a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

E. Entrance Door Hardware:
1. Weatherstripping:
a. Meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin.
b. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be Kawneer Sealair® weathering. This is comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
2. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners (Necessary to meet specified performance tests).
3. Threshold: Extruded aluminum, one piece per door opening, with ribbed surface.
4. Continuous Hinge: As specified in Section 08 71 00.
5. Push/Pull: As specified in Section 08 71 00.
6. Closer: As specified in Section 08 71 00.
7. Latch Handle: As specified in Section 08 71 00.
8. Cylinder(s)/Thumbturn: As specified in Section 08 71 00.

## 2.4 FABRICATION

A. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce interior horizontal head rail to receive blind track brackets and attachments.

G. Reinforce components internally for door hardware and door operators.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

## 2.5 SHOP FINISHING

A. Interpon® D2000, AAMA 2604, Powder Coating. Color as selected by Architect from manufacturer's standard colors.

## 2.6 SOURCE QUALITY CONTROL

A. Source Quality: Provide aluminum framing specified herein from a single source.
1. Building Enclosure System: When aluminum framing is part of a building enclosure system, including entrances, entrance hardware, windows, curtain wall system and related products, provide building enclosure system products from a single source manufacturer.

B. Fabrication Tolerances: Fabricate aluminum framing in accordance with framing manufacturer's prescribed tolerances.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer's acceptable tolerances.
   1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

### 3.2 INSTALLATION

A. Install framing system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual.
   1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
   2. Weathertight Construction: Install sill members and other members in a bed of sealant or with joint filler or gaskets, to provide weathertight construction. Coordinate installation with wall flashings and other components of construction.
   3. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
   4. Provide alignment attachments and shims to permanently fasten system to building structure.
   5. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

B. Install entrance system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual.
   1. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
   2. Provide alignment attachments and shims to permanently fasten system to building structure.
   3. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.
   4. Set thresholds in bed of mastic and secure.
   5. Adjusting: Adjust operating hardware for smooth operation.

C. Install window units plumb, level, and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.
   1. Dissimilar Materials: Provide separation of aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.
   2. Weathertight Construction: Install sill members and other members in a bed of sealant or with joint filler or gaskets, to provide weathertight construction. Coordinate installation with wall flashings and other components of construction.
      a. Refer to Section 07900 – Joint Sealers for installation requirements.

D. Related Products Installation Requirements:
   1. Sealants (Perimeter): Refer to Section 07 90 00.
   2. Glass: Refer to Section 08 80 00 - Glazing.

a. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

## 3.3 FIELD QUALITY CONTROL

A. Section 01 45 23 – Testing and Inspection: Field inspecting, testing, adjusting, and balancing.

B. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Division 1 Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.
   a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft$^2$, which ever is greater.
   b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf.

## 3.4 MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services: Upon Owner's or Architect's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Monitor and report installation procedures and unacceptable conditions.

## 3.5 CLEANING

A. Section 01 74 00 - Cleaning: Final cleaning.

B. Repair or replace damaged installed products.

C. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

D. Remove construction debris from project site and legally dispose of debris.

## 3.6 PROTECTION OF FINISHED WORK

A. Protect installed product's finish surfaces from damage during construction.

B. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

**END OF SECTION**

# SECTION 08 41 23

# FIRE RATED GLASS AND FRAMING SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Fire-rated curtain wall systems, including full vision fire-rated doors, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

B. Related Sections include the following:
1. Section 05 12 00 - Structural Steel Framing: Steel attachment members
2. Section 05 50 00 - Metal Fabrications: Steel attachment members inserts and anchors
3. Section 07 27 00 - Air Barriers: Perimeter air, water and vapor seal between the work of this section and adjacent construction
4. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashing between this work and other work
5. Section 07 84 00 - Firestopping: for perimeter fire-containment systems (safing insulation) field installed with steel fire-rated glazed curtain-wall systems.
6. Section 07 90 00 – Joint Protection: For installation of joint sealants installed with steel fire-rated glazed curtain-wall systems and for sealants to the extent not specified in this Section.
7. Section 08 71 00 – Door Hardware: Door hardware not provided by this Section.
8. Section 08 41 13 – Aluminum-Framed Entrances and Storefronts: Non-fire-rated glass and framing.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
3. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2007.
5. ASTM A1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b.
6. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
7. ASTM C864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
8. ASTM C1048 – Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT, Coated and Uncoated Glass.
9. ASTM E119: Methods for Fire Tests of Building Construction and Materials.

B. National Fire Protection Association (NFPA):
1. NFPA 80: Fire Doors and Windows.
2. NFPA 251: Fire Tests of Building Construction & Materials
3. NFPA 252: Fire Tests of Door Assemblies

4. NFPA 257: Fire Test of Window Assemblies

C. Underwriters Laboratories, Inc. (UL):
1. UL 9: Fire Tests of Door Assemblies
2. UL 10 B: Fire Tests of Door Assemblies
3. UL 10 C: Positive Pressure Fire Tests of Window & Door Assemblies
4. UL 263: Fire tests of Building Construction and Materials
5. UL-752: Ratings of Bullet-Resistant Materials

D. Uniform Building Code
1. UBC 7-2 (1997) -- Fire Tests of Door Assemblies, Parts I and II
2. UBC 7-4 (1997) -- Fire Tests of Window Assemblies

E. American National Standards Institute (ANSI):
1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

F. Consumer Product Safety Commission (CPSC):
1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

## 1.3 PERFORMANCE REQUIREMENTS

A. System Description:
1. Steel fire-rated glazed curtain wall system, outside glazed pressure plate, cover cap format.
2. Face Width: 1 3/4-inch.
3. Water Drainage:
a. System is vertically weeped. No joint plugs or weep holes at horizontal mullions. Horizontal gaskets are notched and received by vertical gaskets.

B. Structural Loads:
1. Uniform Wind Load: ASTM E 330; Static air design load of 40 psf applied in positive and negative direction; no deflection in excess of L/175 of span of any framing member at design load.
2. At structural test load equal to 1.5 times specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
3. Seismic Loads: <Insert specific loads>.

C. Fire Rating Requirements:
1. Duration - Doors: Capable of providing a fire rating of 60 minutes.
2. Duration - Windows: Capable of providing a fire rating for 60 minutes.
3. Duration - Walls: Capable of providing a fire rating for 60 minutes.

## 1.4 SUBMITTALS

A. Submit in accordance with Section 01 32 19 – Submittal Procedures.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

C. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of steel fire-rated glazed curtain-wall systems.
1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Hardware schedule: list of manufacture supplied hardware and verification of cylinder size complying with Section 08 71 00

E. Samples for Initial Color Selection: For steel frames with factory-applied powder coat color finishes.
1. Triplicate copies of manufacturer's powder coating color charts showing the full range of colors available.

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

G. Samples:
1. Submit two 8-inch x 10 inch samples for glass.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.
1. Engineering Responsibility: Preparation of data for glazed curtain-wall systems including the following:
a. Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252, ASTM E119. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

D. Certification: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
1. Door assemblies shall be tested to the acceptance criteria of ASTM E2074-00, NFPA 252, UL 9, UL 10-C Standard Methods of Fire Tests of Door Assemblies.
2. Window assemblies shall be tested to the acceptance criteria of ASTM E2010-01, NFPA 257, UL 10-B, UL 10-C Standard methods for Fire Tests of Window Assemblies.
3. Wall assemblies shall be tested to the acceptance criteria of ASTM E119, NFPA 251, UL 263 Standard Test Methods for Fire Tests of Building Construction and Materials.
4. Underwriters Laboratories (UL) shall conduct fire test.

E. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by an approved independent agency maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

F. Door assemblies shall be marked with the hourly rating followed by the letter "S". The letter "S" indicates air leakage resistance testing conformance to UBC 7-2 Parts I and II.

G. Regulatory Requirements: Comply with provisions of the following:
1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG),"; ANSI A117.1; FED-STD-795, "Uniform Federal Accessibility Standards,"; as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:
1) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

2. NFPA 101: Comply with the following for means of egress doors:
a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

H. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle material and components to avoid damage. Protect curtainwall material against damage from elements, construction activities, and other hazards before, during and after curtainwall installation.

## 1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for steel fire-rated glazed curtain-wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.8 WARRANTY

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel fire-rated glazed curtain-wall systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water leakage.
e. Failure of operating components to function normally.

C. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturer Glazing Material: "Pyrostop™" fire-rated glazing as manufactured by the Pilkington Group and distributed by Technical Glass Products, 600 6th Street South, Kirkland, WA 98033 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com, web site http://www.fireglass.com.

B. Frame System: "Fireframes® Curtainwall Series" fire-rated steel frame system as supplied by Technical Glass Products, 600 6th Street South, Kirkland, WA 98033 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com web site http://www.fireglass.com.

C. Door System: "Fireframes® Heat Barrier Series" fire-rated steel door system as manufactured and supplied by Technical Glass Products, 2425 Carillon Point, Kirkland, WA 98033 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com web site http://www.fireglass.com

D. Substitutions: Section 01 60 00 – Product Requirements: Product options and substitutions.

### 2.2 MATERIALS - GLASS

A. Fire Rated Glazing: ASTM C 1036 and ASTM C 1048; composed of multiple sheets of "Optiwhite" high visible light transmission glass laminated with an intumescent interlayer.

B. Thickness of Glazing Material: Pyrostop™ 60, 27mm, 1-1/16 inch.

C. Approximate Visible Transmission: Varies with thickness (approximate range 75 to 88 percent).

D. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture.

### 2.3 MATERIALS - STEEL FRAMING

A. Steel Curtainwall Framing System: 60 minute rated.
   1. Steel Frame: Profiled steel tubing permanently joined with steel bolts.
   2. Steel Pressure Plates: Formed stainless steel pressure plate with dimensions recommended by manufacturer to securely hold glazing material in place.
   3. Cover Caps: Formed steel.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).

C. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 611.
   3. Hot-Rolled Sheet and Strip: ASTM A 570/A 570M.

D. Brackets and Reinforcements: Manufacturer's standard high-strength materials with nonstaining, nonferrous shims for aligning system components.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

F. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

## 2.4 MATERIALS – DOORS

A. Manufacturer's standard double leaf doors with manufacture's standard hardware.

B. Coordinate door hardware with cylinder specified in Section 08 71 00 Hardware.

## 2.5 ACCESSORIES

A. Exposed Fasteners: Use fasteners fabricated from Type 304 or Type 316 stainless steel.

B. Glazing Gaskets:
1. Interior Applications: Glaze Pyrostop glass with approved, closed cell PVC tape, or pure silicone sealant

C. Intumescent Tape: As supplied by frame manufacturer.

D. Setting Blocks: Calcium silicate.

E. Perimeter Anchors: Steel or 316 Stainless steel when exposed.

F. Flashings: As recommended by manufacturer; same material and finish as cover caps.

G. Silicone Sealant: One-Part Low Modulus, High Movement-Capable Sealant: Type S; Grade NS; Class 25 with additional movement capability of 100 percent in extension and 50 percent in compression (total 150 percent); Use (Exposure) NT; Uses (Substrates) M, G, A, and O as applicable. (Use-O joint substrates include: Metal factory-coated with a high-performance coating; galvanized steel; ceramic tile.)
1. Available Products: Dow Corning 790 - Dow Corning Corp.

H. Intumescent Caulk: Single component, latex-based, intumescent caulk designed to stop passage of fire, smoke, and fumes through fire-rated separations; permanently flexible after cure; will not support mold growth; flame spread/smoke developed 10/10.
1. Available Products: Firetemp CI - John-Manville.

## 2.6 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER INSULATION

A. Available Manufacturers:
1. Fibrex Insulations Inc.

2. Owens Corning.
3. Thermafiber.

B. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Board Insulation: ASTM C 612, maximum flame-spread and smoke-developed indexes of 15 and 0, respectively; passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:
1. Nominal density of 4 lb/cu. ft., Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fiber Color: Regular color, unless otherwise indicated.

## 2.7 FABRICATION

A. General:
1. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
2. Accurately fit and secure joints and corners. Make joints flush and weatherproof.
3. Prepare components to receive anchor devices.
4. Fabricate anchors.
5. Arrange fasteners and attachments to be concealed from view.

B. Door and Frame Assemblies:
1. Furnish frame assemblies pre-welded.
   a. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.
   b. Fit with suitable fasteners.
   c. Knock-down door perimeter frames are not permitted
2. Field glaze door and frame assemblies.
3. Factory prepare steel door assemblies field mounting of hardware
4. Fabrication Dimensions: Fabricate fire rated assembly to field dimensions.
5. Obtain reviewed Shop Drawings prior to fabrication.

## 2.8 DOOR HARDWARE FOR PAIRED DOORS

A. Furnish hardware with 60 minute fire door by the manufacturer. Select hardware from door manufacturer's standard recommended and approved hardware groups as specified in Section 08 71 00 - Door Hardware.
1. All hardware BHMA Certified

B. Provide high traffic areas or areas requiring a door motion force of greater than 20 pounds with power assisted hardware for use with manufacturer's frame system.

C. Operating hardware for Fireframes® Heat Barrier Series Active-Active Pair of Doors with Exit Device Outswing. Each pair to have the following.

| | Item | Description | Manufacturer | Finish* |
|---|---|---|---|---|
| 6 | Hanging Devices | Weld on Pivots | Technical Glass Products | PTM |
| 2 | Exit Device | F5100 Concealed | Dorma | 630 |
| 2 | Lever Trim | Rectangular lever handles | Technical Glass Products | 630 |
| 1 | Cylinder | ANSI Mortise Schlage C Keyway | Technical Glass Products | 626 |
| 2 | Closing Devices | TS 93 Surface Applied Closer | Dorma | 689 |
| 1 | Coordinator | GSR | Dorma | 689 |
| 1 | Auxiliary Fire Latch | Used with exit device with no bottom rod | Technical Glass Products | 630 |
| 2 | Auto door Bottoms | 420APKL Smoke Seal | Pemko | MA |

| | | | | |
|---|---|---|---|---|
| 1 | Weather Seal | Perimeter Gasket | Technical Glass Products | |
| | Balance of hardware by others | | | |

## 2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish frames after assembly.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

## 2.10 INTERIOR STEEL FINISHES

A. Color-Coated Finish: Apply manufacturer's standard powder coating finish system applied to factory-assembled frames before shipping, complying with manufacturer's written instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive curtain wall system and sill plate is level in accordance with manufacturer's acceptable tolerances.
   1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

## 3.2 INSTALLATION

A. General: Install curtain wall systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.

B. Install fire window framing and fully welded fire doors by a specialty contractor with appropriate experience qualifications; and in strict accordance with the approved shop drawings. Employ experienced mechanics familiar with this type of specialized work.

C. Glazing: Glass shall be outside glazed and held in place with stainless steel pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 12-inches on center.

D. Install glazing in strict accordance with fire resistant glazing material manufacturer's specifications. Field cutting or tampering is not permissible.

E. Firmly pack perimeter of framing system to rough opening with mineral wool fire stop insulation or appropriately rated intumescent sealant.

## 3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

## 3.4 ADJUSTING

A. Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

## 3.5 PROTECTION AND CLEANING

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect steel fire-rated glazed curtain-wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

**END OF SECTION**

# SECTION 08 71 00

# DOOR HARDWARE

## PART 1 – GENERAL

### 1.1 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following, but is not necessarily limited to:
1. Door Hardware, including electric hardware.
2. Storefront and Entrance door hardware.
3. Gate Hardware.
4. Digital keypad access control devices.
5. Hold-open closers with smoke detectors.
6. Wall or floor-mounted electromagnetic hold-open devices.
7. Power supplies for electric hardware.
8. Low-energy door operators plus sensors and actuators.
9. Cabinet locks & padlocks.
10. Thresholds, gasket and weather-stripping.
11. Door silencers or mutes.

C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
1. Section 06 20 00 - Finish Carpentry: Finish Hardware Installation.
2. Section 08 12 14 - Standard Steel Frames.
3. Section 08 13 14 - Standard Steel Doors.
4. Section 08 14 16 - Flush Wood Doors.
5. Section 08 14 33 - Stile and Rail Wood Doors.
6. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
7. Section 08 41 23 - Fire Rated Glass and Framing Systems.
8. Section 28 13 00 - Access Control and Alarm Monitoring system (ACAMS).
9. Section 28 31 00 – Fire Detection and Alarm System.

### 1.2 REFERENCES (Use date of standard in effect as of Bid date.)

A. ADAAG - Americans with Disabilities Act (ACT) Accessibility Guidelines for Buildings and Facilities.

B. BHMA - Builders' Hardware Manufacturers Association.

C. CCR - California Code of Regulations, Tile 24, Part 2, California State Accessibility Standards.

D. DHI - Door and Hardware Institute.

E. NFPA - National Fire Protection Association:
1. NFPA 80 - Fire Doors and Windows
2. NFPA 101 - Life Safety Code
3. NFPA 105 - Smoke and Draft Control Door Assemblies

F. CBC – 2007 California Building Code.

G. UL - Underwriters Laboratories:

1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

H. WHI - Warnock Hersey Incorporated.

I. SDI - Steel Door Institute.

## 1.3 SUBMITTALS AND SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.

B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Submit six (6) copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
1. Type, style, function, size and finish of each hardware item.
2. Name, part number and manufacturer of each item.
3. Fastenings and other pertinent information.
4. Location of hardware set coordinated with floor plans and door schedule.
5. Explanation of all abbreviations, symbols and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.
8. List of manufacturers used and their nearest representative with address and phone number.
9. Keying information.

D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

F. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

G. Furnish as-built/as-installed schedule with close-out documents, including keying schedule, wiring/riser diagrams, manufacturers' installation, adjustment and maintenance information.

## 1.4 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Responsible for detailing, scheduling and ordering of finish hardware.
2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
3. Stock parts for products supplied and be capable of repairing and replacing hardware items found defective within warranty periods.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

## 1.5 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least one week prior to beginning work of this section.

B. Attendance: Architect, Construction Manager, Contractor, hardware supplier, installer, key District personnel, and Project Inspector.

C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

## 1.6 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

D. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

E. Ship all permanent keys, cylinders and/or cores directly from lock manufacturer to Owner.

## 1.7 WARRANTY

A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
1. Closers: Ten (10) years, except electronic closers which shall be two (2) years.
2. Exit devices: Three (3) years.
3. Locksets: Seven (7) years
4. All other hardware: Two (2) years.

## 1.8 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

| | Item | Manufacturer | Match Existing Standards |
|---|---|---|---|
| A. | Hinges | Hager / Ives | Matches existing standard |
| B. | Locks, Latches & Cylinders | Schlage | Matches existing standard |
| C. | Exit Devices | Von Duprin | Matches existing standard |
| D. | Closers | LCN | Matches existing standard |
| E. | Push, Pulls & Protection Plates | Ives | Matches existing standard |
| F. | Flush Bolts | Ives | Matches existing standard |
| G. | Dust Proof Strikes | Ives | Matches existing standard |
| H. | Coordinators | Ives | Matches existing standard |
| I. | Stops | Ives | Matches existing standard |
| J. | Thresholds | National Guard | Pemko |
| K. | Seals & Bottoms | National Guard | Pemko |

## 2.2 MATERIALS

A. Continuous Hinges: As manufactured by Select Products Limited. UL rated as required.

B. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Sparta" design fastened with through-bolts.
   1. Chassis: Cylindrical design, zinc plated for corrosion-resistance.
   2. Latch Bolt: Steel, ½" (12mm) throw, deadlocking on keyed and exterior functions. 3/4" (19mm) throw anti-friction latch available for pairs of fire doors.
   3. Faceplate: Brass, bronze or stainless steel. 1-1/8" x 2-1/4" square corner, beveled.
   4. Lever Trim: Accessible design, pressure cast zinc, plated to match finish symbols. Roses: brass
   5. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
   6. Vandlgard Function: 7 year warranty, outside lever is disengaged when in the locked mode.

7. Rosettes: Minimum 3-7/16" diameter for coverage of ANSI/DHI A115.18, 1994 door preparation, through-bolt lugs on both spring cages to fully engage this pattern.
8. Springs: Full compression type.
9. Strikes: 16 gage curved steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.

C. Exit devices: Von Duprin as scheduled with push-through pad design, no exposed touch bar fasteners, no exposed cavities when operated.
1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 1994 standards.
2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
3. Mechanism case shall have an average thickness of 0.140 inch.
4. Compression spring engineering.
5. Non-handed basic device design with center case interchangeable with all functions.
6. All devices shall have quiet return fluid dampeners.
7. All latchbolts shall be deadlocking with 3/4" throw and have a self-lubricating coating to reduce friction and wear.
8. Device shall bear UL label for fire and or panic as may be required.
9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of 0.130 inch thickness, match lockset lever design.
11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
12. Furnish glass bead kits for vision lites where required.
13. All Exit Devices to be sex-bolted to the doors.
14. Panic Hardware shall comply with UBC Standard 10-4 and shall be mounted between 30" and 44" above the finished floor surface. The unlatching force shall not exceed 15 lbs. applied in the direction of travel. Panic hardware shall comply with CBC Section 1003.3.1.9.

D. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
5. Closers shall be installed to permit doors to swing 180 degrees.
6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.

7. Drop brackets are required at narrow head rails.
8. Maximum effort to operate doors shall not exceed 5 lbs. for exterior doors and 5 lbs. for interior doors, such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the door may be increased to min. allowable by appropriate admin authority not to exceed 15 lbs. (66.72N) 1133B.2.5. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. Reference CBC Sections 1133B.2.1, 1133B.2.5, 1133B2.5.1 & 1003.3.1.8. Doors shall take at least 3 seconds to move from an open position of 70 degrees to a point of 3 inches from the latch jamb.
9. Provide sex-bolted or through bolt mounting for all door closers.

E. Flush Bolts and Dust Proof Strikes: Ives as scheduled.
1. Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
2. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
3. Provide dust proof strikes at openings using bottom bolts.

F. Coordinators: Ives as scheduled.
1. Coordinator shall be a 1-5/8" wide by 5/8" high aluminum channel with the length variable to the door opening. It shall have a safety mechanism which will allow the active door to close first if under extreme pressure.

G. Door Stops: Ives as scheduled.
1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (Title 24, 1133B.8.6).
3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

H. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.

I. Lock Protectors: Lock astragals shall be provided with internally threaded fasteners for flat head machine screws. No hex head or carriage bolt fasteners will be permitted. Must be through bolted to door.

J. Thresholds: As Scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Section 07 90 00 – Joint Protection.
3. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
4. Thresholds shall comply with CBC Section 1133B.2.4.1.

K. Seals: Sponge silicone gasket to meet ASTM E 283-1984 test standards. Provide silicone gasket at all rated and exterior doors. All fire rated openings are to be in compliance with UBC 7.2 and UL 10C.

L. Rain Drips: Provide rain drips at the heads of all exterior doors where there is not enough overhang to protect the opening.

M. Door Shoes and Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

N. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

## 2.3 KEYING

A. Furnish a Grand Master, Master, keyed alike or keyed different system as directed by the District. The District is to verify the Schlage Primus "EP" Level 3 and existing Classic "E" Keyway locations. Conduct a keying meeting with the District to establish all keying requirements.

B. Provide construction keying for doors requiring locking during construction; remove temporary cores immediately prior to District occupancy. Permanent cores and keys are to be shipped directly from the factory to the District.

C. Keys: Supply keys and blanks as follows:
1. Supply 2 cut change keys per lock
2. Supply 50 each "EP" 6 pin key blanks stamped "DO NOT DUPLICATE".
3. Supply 20 construction keys.
4. Supply 3 Cut Construction Control keys and 6 Permanent Cut Control keys.

## 2.4 FINISHES

A. Generally to be SATIN CHROME US26D (626) unless otherwise noted.

B. Furnish push plates, pull plates and kick or armor plates in US 32D(630) unless other wise noted.

C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

## 2.5 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

### 3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 30" and 44" AFF. Per CBC Section 1133B.2.5.1.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

### 3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

## 3.4 HARDWARE LOCATIONS

A. Conform to CCR, Title 24, Part 2, and ADAAG for positioning requirements for persons with disabilities. Operating hardware to be mounted between 30" and 44" above finished floor.

## 3.5 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

## 3.6 SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. The Door Schedule on the Drawings indicates which hardware set is used with each door.

**General Specification**

**Manufacturers Abbreviations (Mfr.)**

| | | | |
|---|---|---|---|
| GLY | = | Glynn-Johnson Corporation | Overhead Stops |
| HAG | = | Hager | Hinges |
| IVE | = | Ives | Push, Pulls, Protection Plates, & Stops |
| LCN | = | LCN | Door Closers, Auto Operators |
| NGP | = | National Guard Products | Thresholds, Gasket & Weatherstrip |
| SCH | = | Schlage Lock Company | Locks, Latches & Cylinders |
| SEL | = | Select | Continuous Hinges |
| VON | = | Von Duprin | Exit Devices & Mullions |

NOTE #1: THIS PROJECT IS TO HAVE A SCHLAGE PRIMUS LEVEL 3 KEYING SYSTEM AT LOCATIONS INDICATED IN THE HARDWARE SCHEDULE. THE BALANCE OF OPENINGS IS TO HAVE A SCHLAGE CLASSIC KEYWAY PER DIRECTION OF THE DISTRICT. ALL PERMANENT CORES AND KEYS ARE TO BE SHIPPED DIRECTLY FROM THE FACTORY TO THE DISTRICT. DURING CONSTRUCTION THE PROJECT IS TO HAVE CONSTRUCTION CORES. VERIFY ALL KEYING REQUIREMENTS WITH DISTRICT.

NOTE # 2: VERIFY THE FINISH OF ALL HARDWARE.

SPECWORKS # 84088-B6VX45KBR

**HW SET: 03 INTERIOR PAIR / RATED**
DOOR NUMBER:
6-101B

EACH TO HAVE:

| | | | | | |
|---|---|---|---|---|---|
| 6 | EA | HINGE | BB1168 4.5 X 4.5 NRP | 640 | HAG |
| 1 | EA | FIRE EXIT HARDWARE | 9927EO-F-LBR | 313 | VON |
| 1 | EA | FIRE EXIT HARDWARE | 9927L-F-LBR 996L X 17 | 313 | VON |
| 1 | EA | IC RIM CYLINDER | 20-057T X ICX (CONST CORE) | 613 | SCH |
| 1 | EA | CORE ONLY | 23-030 (CONVENTIONAL CORE) | 606 | SCH |
| 2 | EA | SURFACE CLOSER | 4041 EDA | 695 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2"LDW | 613 | IVE |
| 2 | EA | DOME STOP | FS436 | 613 | IVE |
| 1 | SET | GASKET | PER SELECTED DOOR MFGR | | |

**HW SET: 31 INTERIOR / BREAK ROOM, MEETING ROOM**
DOOR NUMBER:
5-228A 5-230A 5-304 5-317A 5-350

EACH TO HAVE:

| | | | | | |
|---|---|---|---|---|---|
| 3 | EA | HINGE | BB1279 | 640 | HAG |
| 1 | EA | CLASSROOM LOCK | ND70TD SPA | 613 | SCH |
| 1 | EA | CORE ONLY | 23-030 (CONVENTIONAL CORE) | 606 | SCH |
| 1 | EA | DOME STOP | FS436 | 613 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**END OF SECTION**

# SECTION 08 80 00

# GLAZING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes glass and glazing for metal frames, doors and windows.
   1. Glass glazing materials and installation requirements are included in this section for other sections referencing this section.

B. Related Sections:
   1. Section 07 27 00 - Air Barriers.
   2. Section 07 90 00 - Joint Protection: Sealant and back-up material other than glazing sealants.
   3. Section 08 13 14 - Standard Steel Doors: Glazed doors.
   4. Section 08 14 16 - Flush Wood Doors: Glazed doors.
   5. Section 08 14 13 - Stile and Rail Wood Doors: Glazed doors.
   6. Section 08 41 13 - Aluminum-Framed Storefronts.
   7. Section 08 41 23 - Steel Framed Entrances and Storefronts.
   8. Section 10 80 00 - Toilet Accessories: Metal framed mirrors.

### 1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.

B. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
   1. ASTM C162 – Standard Terminology of Glass and Glass Products.
   2. ASTM C1036 - Standard Specification for Flat Glass.
   3. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
   4. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass.
   5. ASTM E119 - Fire Tests of Building Construction and Materials.
   6. ASTM E330 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   7. ASTM E773 - Standard Test Methods for Seal Durability of Sealed Insulating Glass Units.
   8. ASTM E774 - Standard Specification for Sealed Insulating Glass Units.
   9. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Exterior Windows and Doors.

D. California Building Code: (2007 CBC).

E. California State Fire Marshal:
   1. CSFM 43-7 – FireTests for Doors and Window Assemblies.

F. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1201 – Safety Standard for Architectural Glazing Materials.

G. Flat Glass Marketing Association (FGMA): Glazing and Sealant Manuals.

H. Glass Association of North America:
1. GANA - FGMA Sealant Manual.
2. GANA - Glazing Manual.
3. GANA - Laminated Glass Design Guide.
4. GANA – Bulletin 01-0300 – Proper Procedures for Cleaining Architectural Glass Products.
5. GANA 89-1-6 - Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifiers.

I. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 252 - Fire Tests of Door Assemblies
3. NFPA 257 - Fire Tests of Window Assemblies.

J. Laminators Safety Glass Association; (LSGA): Standards Manual.

K. Sealed Insulating Glass Manufacturers Association; (SIGMA).

L. Underwriters Laboratories Inc.:
1. UL - Building Materials Directory.
2. UL 9 - Fire Tests of Window Assemblies.
3. UL 10B - Fire Tests of Door Assemblies.
4. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
5. UL 263 - Fire Resistance Ratings.

## 1.3 DEFINITIONS

A. Monolithic glass and coating orientation:
1. Surface 1: Exterior surface (surface facing outdoors).
2. Surface 2: Interior surface (surface facing indoors).

B. Insulated Glass Unit and coating orientation:
1. Surface 1: Exterior surface of outer lite (surface facing outdoors of outboard lite).
2. Surface 2: Interior surface of outer lite (surface facing indoors of outboard lite).
3. Surface 3: Exterior surface of inner lite (surface facing outboard lite).
4. Surface 4: Interior surface of inner lite (surface facing indoors of inboard lite).

C. OPACI-COAT-300® Spandrel glass: Glass that has been rendered opaque with a water-based silicone elastomeric spandrel coating for non-vision applications.

## 1.4 PERFORMANCE REQUIREMENTS

A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:
1. In conjunction with materials described in Section 07 27 00 and 07 90 00.
2. To utilize inner pane of multiple pane sealed units for continuity of air barrier and vapor retarder seal.
3. To maintain continuous air barrier and vapor retarder throughout glazed assembly from glass pane to heel bead of glazing sealant.

B. Fire Rated Glass Type 1:
1. Fire-rated tempered glass clear and wireless glazing material for use in impact safety-rated locations with fire rating requirements of 20 minutes without hose stream test; for use in interior and exterior applications.
2. Passes positive pressure test standards UL 10C, UBC 7-2 and UBC 7-4.

C. Fire Rated Glass Type 2: Fire-rated glass ceramic clear and wireless glazing material with surface-applied film listed for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with required hose stream test.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 1/4 inch (6.0 mm) thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
      a. U-Factors: NFRC 100 expressed as Btu/sq. ft. per h per degree F.
      b. Solar Heat Gain Coefficient: NFRC 200.
      c. Solar Optical Properties: NFRC 300.

## 1.5 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Glass: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
   2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.
   3. Submit opacifier manufacturer's Product Data Sheet and glazing instructions.

D. Samples:
   1. Glass: Submit two samples 6 inch by 6 inch in size, illustrating each glass type, coloration, and design.
   2. Glazing Materials: Submit 12 inch long bead of glazing sealant proposed to be used, installed between sample of the material to be glazed, fully cured. Color as selected by Architect.

E. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.

F. Manufacturer's Certificate: Certify sealed insulated glass meets or exceeds specified requirements.

G. Installation Instructions: Manufacturers' recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

H. Submit compatibility reports from component manufacturers (such as opacifier, sealants, gaskets, setting blocks, etc), ensuring that the glazing materials were tested for compatibility.

I. Submit test reports showing that the applied opacifier meets durability requirements as shown in GANA 89-1-6 Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifier, in total without omitted sections.

## 1.6 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual, FGMA Glazing Manual and Sealant Manual, LSGA Standards Manual, and SIGMA Glazing Manual, for glazing installation methods.

B. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL or WHI certifying it for use in tested and rated fire protective assemblies.

C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E152 and UL 10B, labeled and listed by UL or WHI or other certification agency acceptable to authorities having jurisdiction.

D. Fire Rated Door Glazing: Tested in accordance with one of the following and complying with NFPA 80.
   1. NFPA 252; with neutral pressure level at 40 inches maximum above sill at 5 minutes into test.
   2. UL 10C.

E. Apply label from agency approved by authority having jurisdiction to identify each fire rated glass lite.

## 1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three year documented experience.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirments.

B. During storage and handling of glass, provide cushions at edges to prevent impact damage.

## 1.9 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Preinstallation meeting.

B. Convene minimum one week before starting Work of this section.

## 1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 – Product Requirements.

B. Do not install glazing when ambient temperature is less than 50 degrees F.

C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

## 1.11 WARRANTY

A. Section 01 77 00 – Contract Closeout: Product warranties.

B. Furnish 5 year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

C. Furnish 5 year warranty to include coverage for delamination of laminated glass and replacement of same.

D. Furnish 10 year warranty that the opacifying coating will not lose adhesion, flake, peel, chip or develop any noticeable color change for a period of ten (10) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GLAZING

A. Manufacturers:
1. Libbey-Owens-Ford.
2. Northwest Industries, Inc.
3. PPG Industries.
4. Old Castle Glass.
5. Technical Glass Products.
6. ICD High Performance Coatings; www.icdcoatings.com
7. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

B. General:
1. For all glass, provide the type and thickness shown on the Drawings or specified herein.
2. Where type or thickness, or both, are not shown on the Drawings or specified herein, provide type and thickness directed by the Architect.

C. Plate or Float Glass:
1. Clear Float Glass: ASTM C1036, Type 1 tranparent flat, Class 1 clear, no tint, Quality q3 glazing select, minimum 3/16-inch thick.
2. Provide safety glass where required by 2001 California Building Code, Section 2406.
3. Where plate glass is called for, plate glass or float glass may be used.

D. Tempered Glass:
1. Provide tempered glass where indicated on the Drawings, and elsewhere as required by governmental agencies having jurisdiction.
2. Clear Tempered Glass: ASTM C1048, Kind FT fully tempered, Condition A, uncoated, Type 1 transparent flat, Class 1 clear, Quality $q^3$ glazing select.
3. Sizes and cutting:
   a. Prior to tempering or heat treating, cut glass to required sizes as determined by accurate measurements of the openings to be glazed, making allowances for required edge clearances.
   b. Cut and process edges in accordance with the glass manufacturer's recommendations.
   c. Do not cut or treat edges in the field.
4. Fully tempered glass:
   a. Wherever possible, locate tong marks along an edge which will be concealed in the glazing system.
   b. Permit minimum warpage practicable.

E. Clear Laminated Glass: ASTM C1172, Kind LA, clear flat glass, with plastic interlayer.
1. 2 layers transparent flat 1/8-inch thick, tempered with no gray tint, Quality $q^3$ glazing slect sandwiched around clear plastic film.

a. Safety glass shall conform to 2001 CBC Section 2406.
b. Tempered glass shall have an etched manufacturer's label on each and every pane of safety glass.
c. Provide where shown on drawings and schedules.

F. Insulated Low-E Glass Units (Type IG): Total unit thickness 1 inch.
1. Double Pane Insulated Glass Units: ASTM E774, Class A, and E773, with glass elastomer edge seal; purge interpane space with dry hermetic air.
a. Manufacturer: PPG Industries, Inc.
b. Type: Solor Control Low-E Clear Insulating Glass.
c. Product: Solarban® 60 (2) "Clear".
d. Visible Light Transmittance: 69 percent.
e. U-Value Winter: 0.29.
f. U-Value Summer: 0.29.
g. SHGC: 0.37.
h. Shading Coefficient: 0.44.
i. Outer Pane: Low E Clear float glass. Sputter Coated on second surface (2).
j. Inner Pane: Clear transparent float glass.
k. Outdoor Visible Light Reflectance: 12 percent.

G. Uncoated Insulated Glass Units (Type IG-UC) for Interior Storefront Locations: Total unit thickness 1 inch.
1. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this paragraph.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design performance requirements specified in Article 1.4.
3. Provide Kind FT (fully tempered) glass lites where safety glass is indicated on drawings or required per code.
4. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
5. Sealing System: Comply with requirements in Section 07 90 00 – Joint Protection. Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
6. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
a. Spacer Material: Aluminum with mill or clear anodic finish.
b. Desiccant: Molecular sieve or silica gel, or blend of both.
c. Corner Construction: Manufacturer's standard corner construction.
7. Uncoated Insulating Glass.
a. Manufacturer: PPG Industries, Inc.
b. Type: Clear Insulating Glass.
c. Clear color, low-reflective outdoor glass.
d. Product: Clear + Clear.
e. Visible Light Transmittance: 79 percent.
f. SHGC: 0.70.
g. Shading Coefficient: 0.81.
h. Outdoor Visible Light Reflectance: 15 percent.
i. U-Value Winter: 0.47.
j. U-Value Summer: 0.50.
k. Insulating Unit Construction: 1/4 inch clear glass + 1/2 inch air space + 1/4 inch clear glass.

H. Fire Rated Glass Type 1: Glazing materials to be types approved for used with specified materials in fire rated applications as indicated on Drawings. Minimum 1/4 inch thick unless otherwise indicated.
1. Product: Fireglass20® as manufactured by J.R. Four Ltd., and distributed by Technical Glass Products, Kirkland, Washington, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, web site www.fireglass.com.
2. Properties:
1. Thickness: 1/4 inch.
2. Weight: 3.0 lbs./sq. ft.
3. Approximate Visible Transmission: 89 percent.
4. Approximate Visible Reflection: 8 percent.
5. Fire-rating: 20 minutes (WITHOUT HOSE STREAM TEST).
6. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
3. Labeling: Permanently label each piece of fireglass 20™ with the fireglass 20™ logo, UL logo and fire rating in sizes up to 6,396 sq. in.
4. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00; NPFA 252; UL 9, UL 10B and UL10C.

I. Fire Rated Glass Type 2: Glazing materials to be type approved for used with specified materials in fire rated applications as indicated on Drawings. Minimum 3/16 inch thick unless otherwise indicated.
1. Supplier: FireLite® NT as supplied by Technical Glass Products, Kirkland, Washington, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, web site www.fireglass.com
2. Properties:
a. Thickness: 3/16 inch [5 mm] FireLite®.
b. Film: Fire-rated surface film as approved by manufacturer.
c. Weight: 2.4 lbs./sq. ft.
d. Approximate Visible Transmission: 88 percent.
e. Approximate Visible Reflection: 9 percent.
f. Hardness (Vicker's Scale): 700.
g. Fire-rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications.
h. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
i. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.
j. Surface Finish: Premium (polished).
3. Maximum sheet sizes based on surface finish:
a. Premium: 48 inches by 96 inches.
b. Standard: 48 inches by 96 inches.
c. Obscure: 36 inches by 96 inches.
4. Labeling: Permanently label each piece of FireLite® NT with the FireLite® logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite® label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).
5. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00 and ASTM E2010-01; NPFA 252 and NFPA 257; and UL 9, UL 10B and UL 10C.

J. Spandrel Coated Glass: ASTM C1048.
1. Monolithic OPACI-COAT-300® Spandrel Glass.
a. The OPACI-COAT-300® opacifying coating shall have a minimum thickness of 4-5 mils dry (0.004 inch /0.10 mm to 0.005 inch/0.127 mm).
b. Only Approved Factory Fabricators (AFF) are allowed to produce the OPACI-COAT-300® silicone spandrel, as AFF glass fabricators are

certified and trained by ICD in the application and manufacture of the spandrel glass.

c. For a list of Approved Factory Fabricators, please contact ICD at 1-360-546-2286 or www.icdcoatings.com.

d. Approved manufacturers of OPACI-COAT-300®:

1) ICD High Performance Coatings, 13911 NW 3rd CT, Vancouver, WA 98685, USA.

2. Glass type: Clear float glass.
3. Nominal thickness: 1/4-inch.
4. Glass strength: (Heat-Strengthened or Tempered).
5. Spandrel Coating Orientation: Surface #2
6. OPACI-COAT-300® Color Name and Number: As selected by Architect from manufacturer's standard colors.
7. US Requirements: GANA 89-1-6 Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifiers, and with other requirements as specified.

## 2.2 ACCESSORIES

A. General: Materials recommended by glass or glazing material manufacturer.

B. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, insulating glass seals,and glazing channels.

1. Colors: Provide color of exposed sealants, as selected by Architect from manufacturer's standard colors.
1. Silicone Glazing Sealant: ASTM C920, Type S; Grade NS; Class and Use suitable for glazing application indicated; single component; chemical curing; capable of water immersion without loss of properties; non-bleading; non-staining, cured Shore A hardness of 15 to 25. Available Products:
   a. Dow Corning 795 – Dow Corning Corp.
   b. Silglaze-II 2800 – General Electric Co.
   c. Spectrum 2 – Tremco Inc.
   d. Structural Silicone: Furnish high-modulus structural silicone glazing materials where sealant bonds glass to substrate.

C. Pre-Formed Glazing Tape: Size to suit application.

1. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal.
   a. Type: As recommended by glazing manufacturer.

D. Setting Blocks and Spacers: Neoprene chemically compatible with specified sealants, unless other specified:

1. Setting Blocks for Fire Rated Glazing: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

E. Glazing Points and Spring Wire Clips: Manufacturer's standard type; corrosion resistant.

F. Fire-Resistant Glazing Materials: Materials used to obtain required fire-resistant rating.

G. Filler Rod: Compressible synthetic rubber or foam.

H. Primer-Sealers and Cleaners: As recommended by glass manufacturer.

## 2.3 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS:

A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 square inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
   a. Norton #990.
   b. Accepted equal.

B. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

C. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

## 2.4 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify openings for glazing are correctly sized and within acceptable tolerance.

B. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.

## 3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

## 3.3 INSTALLATION

A. Perform installation in accordance with GANA Glazing Manual.
   1. Glazing Sealants: Comply with ASTM C1193.
   2. Fire Rated Openings: Comply with NFPA 80.

B. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
   1. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with compatible butyl sealant.
   2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
   3. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
   4. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
   5. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape 1/4 inch below sight line.

6. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
7. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

C. Interior Dry Method (Tape and Tape) Installation:
1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
2. Place setting blocks at 1/3 points with edge block no more than 6 inches from corners.
3. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
4. Place glazing tape on free perimeter of glazing in same manner described above.
5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
6. Knife trim protruding tape.

D. Set glass in a manner which produces the greatest possible degree of uniformity in appearance.
1. Fire Rated Glass Type 1:
   a. Glaze vertically into labeled metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
   b. Place glazing tape on free perimeter of glazing in same manner as described above.
   c. Provide minimum edge clearance of > 1/4 inch (+1/8 inch/-1/16 inch) and a minimum edge cover of < 3/8 inch (+1/16 inch/-1/16 inch).
   d. Install in vision panels in fire-rated doors to requirements of NFPA 80.
   e. Install so that appropriate UL and Fireglass 20™ markings remain visible.
2. Fire Rated Glass Type 2:
   a. Glaze vertically into labeled metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
   b. Place glazing tape on free perimeter of glazing in same manner as described above.
   c. Install removable stop and secure without displacement of tape.
   d. Install in vision panels in fire-rated doors to requirements of NFPA 80.
   e. Install so that appropriate UL and Fireglass 20™ markings remain visible.

E. Do not use two different glazing materials in the same joint system unless the joint use is approved in advance by the Architect.

F. Glaze exterior openings with PVB layer toward the exerior of the building.

G. Mask, or otherwise protect, surfaces adjacent to installation of sealants.

H. Miter-cut and seal the joints of glazing gaskets in accordance with the manufacturer's recommendations, to provide watertight and airtight seal at corners and other locations where joints are required.

I. Spandrel Glass:
1. On OPACI-COAT-300® coating, use a non-acidic sealant. Sealants or bonding materials with acidic or hydrocarbon-based thinners can not be used. Gaskets and setting blocks shall be made of silicone. See ICD High Performance Coatings for a complete list of approved sealants and glazing material.

2. OPACI-COAT-300® is intended for spandrel applications only, not recommended for use in vision areas.

## 3.4 CLEANING

A. Section 01 74 00 – Cleaning: Final cleaning.

B. Remove glazing materials from finish surfaces.

C. Remove labels after Work is complete.

D. Clean glass and adjacent surfaces.

## 3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect glass from breakage after installation by promptly installing streamers or ribbons, suitably attached to the framing and held free from glass. Do not apply warning markings, streamers, ribbons, or other items directly to the glass except as specifically directed by the Architect.

**END OF SECTION**

# SECTION 09 21 16

# GYPSUM BOARD ASSEMBLIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Shaft wall system; gypsum board and joint treatment, exterior gypsum sheathing board, accessories, and textured finish.

B. Related Sections:
1. Section 05 40 00 - Cold-Formed Metal Framing.
2. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking for support of wall-mounted equipment and accessories.
3. Section 07 21 16 - Blanket Insulation: Thermal and acoustic insulation.
4. Section 07 27 00 - Air Barriers.
5. Section 07 84 00 - Firestopping: Firestopping at rated walls and partitions.
6. Section 07 90 00 - Joint Protection: Caulking and sealants.
7. Section 08 31 13 - Access Doors and Frames: Metal access panels.
8. Section 09 22 16 - Non-Structural Metal Framing: Building metal framing system.

### 1.2 REFERENCES

A. ANSI - American National Standards Institute:
1. A118.9 - Test Methods and Specifications for Cementitious Backer Units.

B. ASTM International:
1. ASTM C475 - Standard Specification for Joint Compound and Jont Tape for finishing Gypsum Board.
2. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
3. ASTM C954 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness.
4. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
5. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
6. ASTM C1396 – Standard Specification for Gypsum Board.
7. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
8. ASTM E119 - Method for Fire Tests of Building Construction and Materials.

C. CBC - California Building Code, 2007 Edition; Chapters 7 and 25A.

D. Division of State Architect:
1. DSA IR 25-3, September 1999.

E. GA - Gypsum Association:
1. GA 214 – Recommended Levels of Gypsum Board Finish.
2. GA 216 – Application and Finishing of Gypsum Board.
3. GA 600 – Fire Resistance Design Manual.

F. Intertek Testing Services (Warnock Heresy Listed):
1. WH – Certification Listings.

G. National Fire Protection Association:

1. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials.

H. NWWCB - Northwest Wall and Ceiling Bureau:
1. RS - Recommendations and Specifications.

I. UL – Underwriters Laboratories, Inc.:
1. UL – Fire Resistance Directory and Building Material Directory.
2. UL 723 – Tests for Surface Burning Characteristics of Building Materials.

## 1.3 SYSTEM DESCRIPTION

A. Design Requirements: Where indicated, provide materials and construction which are identical to those assemblies whose fire resistance rating has been determined in accordance with ASTM E119 by a testing and inspecting organization acceptable to authorities having jurisdiction. Products used in the assembly shall carry a classification label from a testing agency acceptable to the authority having jurisdiction.

## 1.4 PERFORMANCE REQUIREMENTS

A. Acoustic Attenuation for Identified Interior Partitions: 35 STC, 39 STC, 45 STC, 49 STC, 53 STC, and 60 STC; in accordance with ASTM E90.

B. Shaft Wall: Perform to the following:
1. Air Pressure Within Shaft: 5.0 psf with maximum mid-span deflection of L/240 inches.
2. Acoustic Attenuation: 47 STC in accordance with ASTM E90.

## 1.5 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's product data on gypsum board, exterior gypsum sheathing board, joint tape, acoustic accessories, and the following:
1. Fire Resistance Data: Include required fire test results for gypsum board systems on partitions, ceilings and columns. Correlate with supporting metal framing details.
2. Sound Transmission Data: Include certified evidence that installed gypsum board systems and materials meet required STC levels.

C. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

## 1.6 QUALITY ASSURANCE

A. Perform Work in accordance with GA-214, GA-216, and GA-600.

B. Fire Rated Wall and Ceiling/Roof Construction: Rating as indicated on Drawings.
1. Tested Rating: Determined in accordance with ASTM E119.
2. Fire Rated Partitions: Listed assembly by UL, GA; File Numbers as shown on drawings.
3. Fire Rated Ceiling: Listed assembly by UL, GA; File Numbers as shown on drawings.
4. Fire Rated Shaft Wall Requirements: One hour in accordance with GA File No. 6800.

## 1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements

B. Acceptance at Site: Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier. Verify board and accessories as undamaged.

C. Storage and Protection:
1. Store materials inside under cover and keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
2. Handle gypsum boards to prevent damage to edges, ends and surfaces.
3. Store and handle steel framing and related accessories in accordance with A.I.S.I Code of Standard Practice."

## 1.9 PROJECT CONDITIONS

A. Environmental Conditions:
1. Establish and maintain environmental conditions for application and finish gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations. Maintain not less than 40 degrees Fahrenheit minimum room temperature.
2. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during day, hot weather to prevent materials from drying too rapidly.

## 1.10 WARRANTY

A. Section 01 77 00 – Contract Closeout: Product warranties.

B. Materials Warranty for Exterior Gypsum Sheathing: Provide sheathing manufacturer's standard warranty covering sheathing materials for five years from date of substantial completion.

C. Weathering Warranty for Exterior Gypsum Sheathing: Provide sheathing manufacturer's standard warranty covering in-place exposure damage to sheathing for six months commencing on date of installation completion.

# PART 2 - PRODUCTS

## 2.1 GYPSUM BOARD ASSEMBLIES

A. Manufacturers:
1. G-P Gypsum Corporation: www.gp.com/gypsum.
2. National Gypsum Company: www.nationalgypsum.com.
3. United States Gypsum Co.: www.usg.com
4. BPB America Inc.: www.bpb-na.com
5. Pabco Gypsum: www.pabcogypsum.com
6. Temple-Inland Inc.: www.templeinland.com
7. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

## 2.2 COMPONENTS

A. Shaft Wall Studs and Accessories:
   1. Manufacturers:
      a. United States Gypsum Co. (USG® Cavity Shaft Walls).
      b. National Gypsum Co. Gold Bond Building Products Division (I-Stud Cavity Shaftwall).
      c. Georgia-Pacific Corp. (Fireguard® Shaft Liner™).
   2. Steel Framing: ASTM C645.
      a. Protective Coating: Manufacturer's standard corrosion-resistant coating.
      b. Studs: Manufacturer's standard CH or CT profile for fire-resistance-rated assembly indicated and in depth and thickness indicated on Drawings, length as required.
      c. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches in depth matching studs and in thickness indicated on Drawings.
      d. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches in depth matching studs, and not less than 0.0329 inch thick.
      e. Corner and End Members: Manufacturer's standard E-profile framing member for use at corners or where assembly terminates at other work, in depth matching studs and in manufacturer's standard thickness not less than the stud thickness indicated on Drawings; length as required.

B. Interior Gypsum Board Materials:

   1. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

   2. Fire Rated Gypsum Board: ASTM C1396; fire resistive type, UL rated; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

   3. Moisture Resistant (Fire Rated) Gypsum Board: ASTM C1396; 5/8 inch thick, maximum available length in place; ends square cut, square edges.

   4. Gypsum Shaftliner (Coreboard): ASTM C442, 1 inch thick, maximum available size in place, beveled edges, ends square cut, identified with UL Classification label.

   5. Impact-Rated Gypsum Board: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C 1629.
      a. Application: High-traffic areas indicated.
      b. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
      c. Paper-Faced Type: Gypsum wallboard as defined in ASTM C 1396/C 1396M.
      d. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C 1278/C 1278M.
      e. Type: Fire-resistance rated Type X, UL or WH listed.
      f. Thickness: 5/8 inch.
      g. Edges: Tapered.
      h. Products:
         1) National Gypsum Company; Gold Bond Hi-Impact Brand XP Wallboard.
         2) Temple-Inland Inc; ComfortGuard AR Abuse Resistant.
         3) Temple-Inland Inc; ComfortGuard IR Impact Resistant.
         4) USG Corporation; Fiberock Brand Panels - VHI Abuse-Resistant.

5) G-P Gypsum Corporation; ToughRock Abuse-Resistant Gypsum Board.

C. Exterior Gypsum Sheathing Board Materials:
1. Acceptable Products:
a. 5/8 inch DensGlass Gold Fireguard sheathing.
2. Composition: Gypsum sheathing manufactured in accordance with ASTM C1177 with glass mats both sides and long edges, water-resistant treated core.
3. Fire Resistance:
a. Non-combustible when tested in accordance with ASTM E136.
b. 5/8 inch DensGlass Gold Fireguard: Sheathing is rated "Type X" as defined in ASTM C36 when tested in according to ASTM E119.
4. Accessories:
a. Joint Tape: 2 inch wide 10 x 10 glass mesh tape.
b. Joint Compound: G-P Gypsum setting-type joint compound.
5. Sealants, Caulk and Tape:
a. Sealant: Dow Corning 795 or equivalent; Pecora 895 or equivalent.
b. Caulk: Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent; Pecora AC-20 acrylic latex sealant; GE Silicone Silpruf Sealant; Tremco Dymonic.
c. Tape: 2 inch wide 10 x 10 glass mesh Quick Tape, or equivalent.

## 2.3 ACCESSORIES

A. Fasteners to Steel Members:
1. Screws: ASTM C1002, Type 'S', 0.190 inch diameter steel drill screws for fastening gypsum board to steel framing members less than 0.033-inch thick. ASTM C954 steel self drilling tapping screws for fastening gypsum board to steel framing members 0.033 to 0.112-inch thick; cadmium-plated for exterior locations.
2. Screws: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

B. Insulation: As specified in Section 07 21 16.

C. Gypsum Board Accessories:
1. Corner Beads and Casing Beads: ASTM C1047, sheet steel zinc coated by hot-dip process. Flanges shall be free of dirt, grease and other materials that may adversely affect bond of joint treatment.

D. Joint Materials: ASTM C475, GA-216, and as recommended by gypsum board manufacturer for project conditions; reinforcing tape, joint compound, adhesive, and water.

## 2.4 FINISHES

A. Levels of Gypsum Board Finish as Defined by Gypsum Association:
1. Level 1:
a. Ceiling Plenum Areas, Concealed Areas, Storage Rooms, Janitor Closets and Where Indicated: All joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
2. Level 2:
a. Glass Mat Backer Board Substrate for Ceramic Tile; and Where Indicated: All joints and interior angles shall have tape embedded in joint compound and 1 separate coat of joint compound applied over all joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
3. Level 3:

a. Areas Which Are to Receive Heavy or Medium Texture (Spray or Hand Applied) Finishes Before Final Painting or Where Heavy Grade Wall Coverings Are to Be Applied as the Final Decoration: All joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free of tool marks and ridges.

4. Level 4:
   a. Offices, Work Rooms and Private Areas and Where Indicated to Receive Light Textures: All joints and interior angles shall have tape embedded in joint compound and 3 separate coats of joint compound applied over all joints, angles, fastener heads and accessories. All joint compound shall be smooth and free of tool marks and ridges
5. Level 5:
   a. Areas to Receive Gloss, Semi-Gloss, Enamel or Nontextured Flat Paints, Where Severe Lighting Conditions Occur, in Lobbies, Waiting Areas and Other Public Spaces and Where Indicated: All joints and interior angles shall have tape embedded in joint compound and 3 separate coats of joint compound applied over all joints, angles, fastener heads and accessories. A thin skim coat of joint compound or a material manufactured especially for this purpose, shall be applied to entire surface. Surface shall be smooth and free of tool marks and ridges.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

B. Examine areas and surfaces to receive gypsum board and verify the following:
   1. Proper alignment and spacing of backing and framing support systems.
   2. Complete installation of mechanical, electrical or other items to be enclosed in partitions that cannot be installed after installation of board.

### 3.2 EXISTING WORK

A. Extend existing gypsum board installations using materials and methods as specified.

B. Repair and remodel existing gypsum board assemblies which remain or are to be altered.

### 3.3 PREPARATION

A. Protect surrounding areas and surfaces to preclude damage.
   1. Exercise care to avoid soiling, spatter and damage to work of other trades.
   2. Use cover clots or other means of protection. Remove, clean and repair any soiled or damaged work as required.
   3. Protect from damage at all times.

### 3.4 INSTALLATION

A. Shaft Wall Framing:
   1. General: install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
      a. GA-600 requirements.

b. ASTM C754 requirements for installing steel framing.

2. Position steel runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and maximum 24 inches on center.
3. Cut liner panels 1 inch less than floor-to-ceiling height and erect vertically between J-Runners. Where shaft walls exceed maximum available panel height, position liner panel end joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels. Screw studs to runners on walls over 16 feet.
4. Use steel C-H studs 3/8-inch to not more than 1/2-inch less than floor-to-ceiling height, and install between liner panels with liner inserted in the groove. Install full-length E-Studs over gypsum liner panels both sides of closure panels. For openings, frame with vertical E-Stud or J-Runner at edges, horizontal J-Runner at head and sill, and reinforcing as shown on drawings. Suitably frame all openings to maintain structural support for wall.
5. Install floor-to-ceiling steel E-Studs each side of steel hinged door frames and jamb struts each side of elevator door frames to act as strut-studs. Attach strut-stud to floor and ceiling runners with two 3/8-inch Type S-12 pan screws. Attach strut-studs to jamb anchors with 1/2-inch Type S-12 screws. Over steel doors, install a cut-to-length section of J-Runner and attach to strut-studs with 3/8-inch Type S-12 screws.
6. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
7. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of installation and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
8. Isolate shaft-wall assemblies from building structure to prevent structural movement from transferring to shaft-wall assemblies.
9. Seal gypsum board shaft-walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C919, whichever is more stringent.
10. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch thick, gypsum board cants covering tops of projections as follows:
    a. Slope cant panels at least 75 degrees from horizontal. Set base of panels in adhesive and secure tope edges to shaft walls at 24 inches on center with screws fastened to shaft-wall framing.
    b. Where required to support gypsum board cants, install steel framing spaced at 24 inches on center maximum; extend studs from top of projection to shaft-wall framing behind cant.

B. Gypsum Board Installation:
1. Install and finish gypsum board to comply with GA-216 and GA-600.
    a. Single Layer: Install in accordance with ASTM C840, except as amended or required by specific fire resistive or sound isolation system detailed. In that instance, application shall conform to requirements of the manufacturer's tests as reviewed and accepted in the submittal.
    b. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
2. Apply in vertical direction with ends and edges falling on supports. In vertical applications, gypsum board shall be of length required to reach full height of vertical surfaces in one continuous piece.

3. Position boards so that like edges abut, tapered edges against tapered edges and field cut ends against field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
4. Start installation of panels at exterior wall to position butt joints as far away from exterior wall as possible.
5. Double Layer Application:
   a. Joints: Stagger 24 inches between layers.
   b. Sound-rated construction: Tape face layer.

C. Fire Resistant Assemblies: Wherever fire rated gypsum board construction is indicated, provide materials and installation methods, including types and spacing of fasteners, in accordance with CBC. Apply firestopping at 10 feet on center vertically within walls, at top of wall and at penetrations through fire resistant assembly in accordance with Section 07 84 00.

D. Sound Retardant Installations:
1. Follow manufacturer's directions and specifications for conditions of installation. Install where indicated. Include around all Toilet Rooms, whether indicated or not. Install from floor surface to bottom side of next floor surface.
   a. Wrap with insulation and seal electrical or other outlets in sound isolating partitions.
   b. Install sealant to completely fill void between gypsum board edges and adjacent surface.
2. Sound-rated edge condition: Stagger (i.e., ship-lap) gypsum board layers at vertical intersections. Provide a 1/4-inch nominal gap around the gypsum board face layer at floor and ceiling intersections. Fill the 1/4-inch gap with acoustical sealant to form an airtight seal.

E. Fastenings: Attach gypsum board to framing with screws, lengths and sizes as recommended by manufacturer and in accordance with CBC, Table 25A-G and 25A-H.
1. General: Place not less than 3/8 inch from edges of board, with heads dimpled slightly below surface; do not cut through paper.
2. Ceilings, Non-rated: Screws, 12 inches on center.
3. Walls, Non-rated: Screws, 12 inches on center.
4. Walls, One-hour Rated: As shown.

F. Access Doors: Install gypsum board into access door frames specified in Section 08 31 13 where required and where indicated on the Drawings. Anchor firmly into position, and align properly to achieve an installation flush with adjacent finished surfaces.

G. Acoustic Accessories Installation:
1. Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
2. Install acoustic sealant at gypsum board perimeter at:
   a. Wood Framing: One bead.
   b. Face Layer.
   c. Seal penetrations of partitions by conduit, pipe, duct work, and rough-in boxes.

H. Accessories:
1. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   a. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   b. At exterior soffits, not more than 30 feet apart in both directions.
2. Corner Beads: Install at external corners, using longest practical lengths.
3. Casing Beads: Install whenever edge of gypsum board would otherwise be exposed or semi-exposed, or where abutting dissimilar materials.
4. After accessories are installed, correct surface damage and defects.
5. Install trims and expansion joints where required.

I. Allowable Tolerances:
   1. Offset Between Planes of Board Faces: 1/16-inch.
   2. Plane, Level, Warp and Bow: 1/8-inch in 8'-0".
   3. Shim panels as necessary to comply with tolerances.

## 3.5 INSTALLATION – EXTERIOR GYPSUM SHEATHING

A. Provide DensGlass Gold sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C1280.

B. Install DensGlass Gold sheathing with gold side out.

C. Use maximum lengths possible to minimize number of joints.

D. Metal Framing: Attach DensGlass Gold sheathing to metal framing with screws spaced 8 inches on center at perimeter where there are framing supports; and 8 inches on center along intermediate framing in field.

E. Drive fasteners to bear tight against and flush with surface of sheathing. Threads of fasteners shall penetrate the steel studs by a minimum of 1/4-inch. Do not countersink.

F. Locate fasteners minimum 3/8 inch from edges and ends of sheathing panels.

G. Air Barrier: Install air barrier over exterior gypsum sheathing as specified in Section 07 27 00, with flashing around openings.

## 3.6 FINISHING OF GYPSUM BOARD

A. Apply joint treatment at gypsum board joints; flanges of corner bead, edge trim and penetrations, fastener heads and surface defects in accordance with ASTM C840 and GA 214 (provide designated level as described in Article 2.4). Number of coats of treatment shall be as specified above.

B. Apply joint tape at joints between gypsum boards.

C. Finish interior gypsum board by applying the number of coats of treatment as specified above. Sand between coats and after last coat.

D. Texture Finish: Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions, and to match approved sample.
   1. Texture Required: Orange-Peel.

E. Finish Painting: As specified in Section 09 90 00.

F. Caulking:
   1. Caulk openings around pipes, fixtures and other items projecting through gypsum board as specified in Section 07 90 00.
   2. Caulk top of fire rated walls and partitions and penetrations through fire rated walls and partitions in accordance with Section 07 84 00.
   3. Apply caulking material with exposed surface flush with gypsum board.

## 3.7 FINISHING OF EXTERIOR GYPSUM SHEATHING

A. Seal fasteners using Dow Corning 795 or Borden HPG Elmers Siliconized Acrylic Latex Caulk or equivalent.

B. Finish joints using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic latex Caulk or equivalent. Reinforce with 2 inch wide 10 x 10 glass mesh Quick Tape or equivalent.

## 3.8 FIELD QUALITY CONTROL

A. Installer shall be present at the Architect's inspection of Work. Touch up as required and directed subsequent to finish application.

## 3.9 ERECTION TOLERANCES

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

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

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

D. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

## 3.10 CLEANING

A. Clean all beads, screeds, metal base, metal trim, mechanical and electrical items.
   1. Wipe clean, leaving work ready for finish specified under other Sections.
   2. As work is completed in each space, clean all rubbish, utensils and surplus materials from the space. Leave floors broom clean.

## 3.11 PROTECTION

A. Provide protection to gypsum board construction from damage or deterioration.

## 3.12 FINISH LEVEL SCHEDULE

A. Finishes in accordance with GA-214 Level:
   1. Level 1: Above finished ceilings concealed from view.
   2. Level 2: Utility areas and areas behind cabinetry.
   3. Level 3: Walls scheduled to receive textured wall finish.
   4. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.
   5. Level 4: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

**END OF SECTION**

# SECTION 09 22 16

# NON-STRUCTURAL METAL FRAMING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes metal stud framing and accessories at interior locations.

B. Related Sections:
1. Section 05 40 00 - Cold-Formed Metal Framing: Structural load bearing metal stud framing.
2. Section 05 50 00 - Metal Fabrications: Metal fabrications attached to stud framing.
3. Section 06 10 53 - Miscellaneous Rough Carpentry: Rough wood blocking within stud framing.
4. Section 07 21 16 - Blanket Insulation: Insulation between framing members.
5. Section 07 27 00 - Air Barriers.
6. Section 09 21 16 - Gypsum Board Assemblies: Metal studs for partitioning.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A879/A879M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
4. ASTM A924: Specification for General Requirements for Steel Sheet Metallic-Coated by the Hot-Dip Process.
5. ASTM A1003/1003M – Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
6. ASTM A1011 - Specification for Steel, Sheet and Strip, Carbon, Hot- Rolled, Structural Quality.
7. ASTM C645-07 - Standard Specification for Nonstructural Steel Framing Members.
8. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
9. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
10. ASTM D1056: Specification for Flexable Cellular Materials -Sponge or Expanded Rubber.

B. National Association of Architectural Metal Manufacturers:
1. NAAMM ML/SFA 540 - Lightweight Steel Framing Systems Manual.

C. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

D. Steel Stud Manufacturer's Association:
1. ICC ER-49043P – Product Technical Information.

### 1.3 SYSTEM DESCRIPTION

A. Interior Walls: Metal stud framing system with batt type acoustic insulation specified in Section 07 21 16, and interior gypsum board specified in Section 09 21 16.

B. Maximum Allowable Deflection:
   1. For interior non-rigid finishes: 1:120.
   2. For interior ceramic tile and plaster finishes: 1:360.

## 1.4 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data describi9ng standard framing member materials and finish, product criteria, load charts, and limitations.

C. Shop Drawings: Submit shop drawings illustrating standard details and special details.
   1. Indicate component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.

D. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

## 1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C754, and NAAMM ML/SFA 540.

B. Form, fabricate, install, and connect components in accordance with NAAMM ML/SFA 540.

C. Furnish framing materials in accordance with SSMA - Product Technical Information.

## 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   1. Framing Manufacturer: Current member of Steel Stud Manufacturers Association.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

## 1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 - Project Meetings: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

## 1.8 COORDINATION

A. Coordinate placement of components within stud framing system specified in Division 26.

# PART2 - PRODUCTS

## 2.1 METAL FRAMING SYSTEM

A. Manufacturers:
   1. Dietrich Industries, Inc.: www.dietrichindustries.com.
   2. California Expanded Metal Products (CEMCO): www.cemco.com.
   3. The Steel Network, Inc (TSN): www.SteelNetwork.com.
   4. Clark Western Building Systems: www.clarkwestern.com
   5. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

## 2.2 COMPONENTS

A. Non-Loadbearing Studs: ASTM C645-07; galvanized sheet steel, non-load bearing rolled steel, channel shaped, punched for utility access, of size and properties necessary to comply with ASTM C754 for the spacing indicated, and as follows:
   1. Subject to compliance with requirements, provide Dietrich UltraSTEEL™ Framing, 20 gauge-equivalent.
   2. Depth: 6 inches, 3-5/8 inches, and as shown.
   2. Thickness: 0.0296 inch (20 gauge); or members that can show independently verified test performance per ASTM C645-07 Section 9.2.

B. Loadbearing Studs: As specified in Section 05 40 00.

C. Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud. Ceiling Runners: With extended leg retainer.

D. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.

E. Channels:
   1. Furring: 25 gage steel sheet, roll-formed, 2-3/4 inch x 7/8 inch deep with 1/2 inch wide flanges.
   2. Runners: 1/2 inch cold formed steel weighing not less than 475 lbs. per 1000 lineal feet, or as indicated.
   3. Stiffeners: 3/4 inch cold formed steel weighing not less than 300 lbs. per 1000 lineal feet; rust-inhibitive coated.
   4. Channel Bridging and Bracing: U-Channel Assembly; Base metal thickness of 0.0538 inch and minimum 1/2-inch wide flanges. Subject to compliance with requirements provide:
      a. Dietrich Metal Framing: Spazzer® 9200 Bridging and Bracing Bar.
      b. U-Channel Assembly: 3/4 inches, 1-1/2 inches, 2 inches, as designated.
         1) Dietrich Metal Framing; EasyClip™ U-Series™ Clip Angle, or equivalent.
   5. Resilient Channel: 1/2 inch deep, steel sheet members designed to reduce sound transmission, galvanized G40.
      1. Subject to compliance with requirements, provide Dietrich Metal Framing Resilient Cannel (RCSD) or (RCUR) UltraSTEEL ™ 20 gauge equivalent.

F. Fasteners: ASTM C1002, self drilling, self tapping screws.
   1. Screws: Type S bugle head; sizes recommended by gypsum board manufacturer.

G. Vertical Deflection Connectors:
   1. Manufacturer's standard (bypass) or (head) clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   2. Mechanical attachment to structure and screw attachment to stud web using step-bushings to permit frictionless vertical movement; 68 mils minimum thickness, size as required by structural design calculations.

3. Required use of connection products that have a valid ICC ES Report or equivalent complying with ICC Acceptance Criteria AC261.
   a. The Steel Network, Inc.: VertiClip® and VertiTrack® (ICC #ESR-1903).
   b. Dietrich Metal Framing; SLP-TRK® Slotted Deflection Track by Brady Innovations.
   c. Dietrich Deflection clips: Fast Strut™ / Fast Top™ Clips / FastClip™ Slide Clips / QuickClip™/ Slide Clip ™ (SD).

H. Firestop Track:
1. As specified in Section 07 84 00 – Firestopping: Fire Resistive Joint Systems. Comply with UL 2079.
2. Available Products: Required use of connection products that have a valid ICC ES Report or equivalent complying with ICC Acceptance Criteria AC261. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. The Steel Network, Inc.: VertiClip® and VertiTrack® (ICC #ESR-1903)
   b. Dietrich Metal Framing, SLP-TRK® Slotted Deflection Track by Brady Innovations.

I. Drift Clips:
1. Manufacturer's standard head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.
2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. The Steel Network, Inc.: DriftClip® and DriftTrack.™
   b. Approved Equivalent.

J. Flat Strap and Backing Plate: Sheet for blocking and bracing in length and width indicated, for reinforcement of accessories:
1. Subject to compliance with requirements, provide Dietrich Metal Framing: Danback™ Fire Treated Wood Backing Plate (D16F) or (D24F).
2. Galvanized Sheet Steel: 0.0538 inch thick.

K. Anchorage Devices: Powder Driven Fasteners:
1. General: Kwik Bolt II manufactured by Hilti, Inc.; 3/16 inch diameter.
2. Expansion Bolts: FS FF-S-325, Group III, expansion shield (self-drilling tubular expansion shell anchor bolts); Type 1 or 2, unless otherwise shown. .
3. Alternate Manufacturers: Comparable products with current ICBO.

L. Acoustic Sealant: As specified in Section 07 90 00.

M. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 (Type I Inorganic) or Type II Organic, zinc rich.

N. Neoprene Tape: ASTM D1056. Grade SCE41, soft sponge neoprene with adhesive one side; black; 1/4 inch x 1/2 inch, unless otherwise shown.

O. Wire Hangers: 8 gage galvanized soft steel wire.

## 2.3 SHOP FINISHING

A. Studs and Channels: Non-Structural Members: Meeting requirements of ASTM C645-07; roll-formed from galvanized steel; complying with ASTM A1003 and ASTM A653 G40 or equivalent corrosion-resistant coating.

B. Tracks and Headers:
1. Structural Members: ASTM A653/A653M G60 Hot dipped galvanized (ASTM C955).

2. Non-Structural Members: Meeting requirements of ASTM C645-07; roll-formed from galvanized steel; complying with ASTM A1003 and ASTM A653 G40 or equivalent corrosion-resistant coating.

C. Accessories: Same finish as framing members.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough-in utilities are in proper location.

### 3.2 PREPARATION

A. Examination: Examine conditions of work in place before beginning work; report defects.

B. Measurements: Take field measurements; report variance between plan and field dimensions.

### 3.3 INSTALLATION OF STUD FRAMING

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Metal Framing:
1. General: ANSI A97.2.
2. Structural Studs: ML/SFA.

C. Assemblies:
1. Fire Rated: Per UL and code requirements. Use one manufacturer for each assembly, unless otherwise permitted by governing authorities.
2. Sound Controlled: Use one manufacturer for each assembly, unless otherwise permitted by manufacturer.

D. Metal Stud Partitions:
1. General: Install complete with matching runner tracks and accessories. Align runner tracks accurately to partition layouts.
2. Floor Runners: Secure with 1/4 inch diameter expansion bolts or powder driven - fasteners at least 1 inch long, where permitted by code. Space fasteners 4 inches from ends of each piece; maximum 24 inches on center intermediately; minimum of 2 fasteners per piece of runner.
3. Ceiling Runners: Fasten as shown.
4. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
5. Studs: Gages, depths, and spacing shown. Where not shown, provide per stud manufacturer's recommendations.
6. Stiffeners: 2 rows at third points for studs with finish one side only; one row at midpoint for studs with finish both sides. Snap into punched web of each stud; nest laps and wire tie.
7. Chase Wall Partitions: Cross brace at quarter points with 5/8 inch thick gypsum wallboard; braces 12 inches by width of partition. Fasten to studs with 3 fasteners per edge.
8. Fabricate corners using minimum of three studs.
9. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.

10. Brace stud framing system rigid.
11. Coordinate erection of studs with requirements of door frames; install supports and attachments.

E. Double Wall Partitions:
1. Do not brace or connect rigid members across separation between stud rows. Use the specified resilient sway bracing only. At fire-rated conditions of 2 hours and less conform to UL Design U493.
2. Provide two welded 16 gage structural studs at sound-rated door openings, unless otherwise detailed.

F. Furred Partitions:
1. General: Install furring channels at 24 inches on center; level and plumb with steel shims.
2. To Concrete: Fasten with powder driven fasteners at 24 inches on center.
3. To Concrete Block: As specified for concrete.
4. To Structural Steel: As specified for metal stud partitions.

G. Blocking: Secure steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, casework, toilet accessories, and as required for built-in items.

H. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Install extended leg ceiling runners.

I. Coordinate placement of insulation in stud spaces after stud frame erection.

J. Install studs vertically at 16 inches on center.

K. Align stud web openings horizontally.

L. Secure studs to tracks using fastener method. Do not weld.

M. Stud splicing is not permissible.

N. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.

O. Coordinate installation of bucks, anchors, and blocking with electrical and mechanical work to be placed within or behind stud framing.

P. Backing: Use steel channels or steel studs secured to studs. Provide backing for support of plumbing fixtures; toilet partitions; wall cabinets; toilet accessories; hardware; and opening frames.

## 3.4 CEILING AND SOFFIT FRAMING

A. Comply with requirements for ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated.

E. Space main carrying channels at maximum 4 feet on center, and not more than 6 inces from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

I. Laterally brace suspension system.

## 3.5 CLEANING

A. General: Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris.

## 3.6 ERECTION TOLERANCES

A. Maximum Variation From Indicated Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

C. Maximum Variation of any Member from Plane: 1/4 inch.

**END OF SECTION**

# SECTION 09 51 13

# ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes suspended metal grid ceiling system and perimeter trim and acoustic panels.

B. Related Sections:
1. Section 07 90 00 - Joint Protection.
2. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling system.
3. Section 26 50 00 - Lighting: Light fixtures in ceiling system.
4. Section 28 31 00 - Fire Detection and Alarm System: Fire alarm components in ceiling system.

C. Alternates: Refer to Section 01 23 00 – Alternates, for work of this section affected by Alternates.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
3. ASTM C635 – Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
4. ASTM C636 – Practice for Installation Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
6. ASTM E580 – Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
7. ASTM E795 - Practices for Mounting Test Specimens During Sound Absorption Tests.
8. ASTM E1264 - Classification of Acoustical Ceiling Products.

B. CBC - California Building Code, 2007 Edition.

C. Ceilings and Interior Systems Construction Association:
1. CISCA - Acoustical Ceilings, Use and Practice.

D. Division of the State Architect – Interpretations of Regulations:
1. IR 25-2: Metal Suspension Systems for Lay In Panel Ceilings.

E. ICBO - International Conference of Building Officials:
1. UBCS - Uniform Building Code Standards.
   a. 25 - 2 - Metal Suspension Systems for Acoustical Tile and for Lay-In Panel Ceilings.

F. Intertek Testing Services (Warnock Hersey Listed):
1. WH – Certification Listings.

G. Underwriters Laboratories, Inc:
1. UL – Fire Resistance Directory.

2. UL723 –Tests for Surface Burning Characteristics of Building Materials.

## 1.3 SYSTEM DESCRIPTION

A. Design Requirements:
1. Plumb, true, straight and rigid framing for support of attached materials.
2. Design system to accommodate construction tolerances, deflection of building structural members, support of attached materials and clearances of intended openings in accordance with CBC.
3. Seismically anchor ceiling in accordance with UBC Standard 25-2 for heavy-duty structural classification.

## 1.4 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Submit shop drawings showing suspension system details and reflected ceiling plans indicating location of light fixtures, mechanical air supply and return outlets and other items affecting ceiling construction. Identify locations of types of suspension systems and types of panels or tile including access panels, where required.

C. Product Data: Submit manufacturer's product data for each type of product specified.

D. Samples: Submit samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
1. Submit 6 inch by 12 inch samples of each panel type, pattern, and color.
2. Set of 12 inch long samples of concealed suspension system members.
3. Set of 12 inch long samples of exposed moldings for each color and system type required.

E. Certificates: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

F. Research reports or evaluation reports of ICBO acceptable to authorities having jurisdiction that show compliance of components with DSA IR 25-2 and CBC.

G. Closeout:
1. General: Refer to Section 01 77 00 – Contract Closeout: Contract Closeout.
2. Maintenance Data: Manufacturer's instructions.
3. Guarantee: Provide in required form for a period of one (1) from date of final acceptance by Owner.

## 1.5 QUALITY ASSURANCE

A. Conform to CISCA requirements.

B. Single-Source Responsibility: Provide acoustical panel units and grid components by a single source manufacturer.

C. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
   a. Flame Spread: 25 or less
   b. Smoke Developed: 50 or less

D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

E. Suspended ceilings will be subject to special inspection.

## 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

## 1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 - Administrative Requirements: Pre-installation meeting.

B. Convene one week prior to commencing work of this section.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Deliver acoustical panels and suspension system components to Project site in original, unopened packages.

B. Storage and Protection:
1. Store acoustical panels and suspension components in fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
2. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
3. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## 1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 – Product Requirements.

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

## 1.10 SEQUENCING AND SCHEDULING

A. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustic units after interior wet work is dry.

## 1.11 EXTRA MATERIALS

A. Section 01 77 00 – Contract Closeout: Spare parts and maintenance products.

B. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Acoustical Ceiling Panel: Furnish quantity of full-size units equal to 10 percent of each type panel installed.

## PART 2 - PRODUCTS

### 2.1 SUSPENDED ACOUSTICAL CEILINGS

A. Manufacturer:
   1. USG Interiors; www.usg.com.
   2. Armstrong; www.armstrong.com.
   3. Substitutions: Not permitted. USG Interiors is District standard.

B. Grid:
   1. General: Heavy Duty System manufactured by USG Interiors, Inc.; Donn.
   2. Substitutions: Not permitted. USG, Donn/DX is District standard.

C. Non Fire-Rated Grid: ASTM C6355 heavy duty exposed tees, all components die cut and interlocking, commercial quality, cold rolled steel with galvanized coating.
   1. Non Fire-Resistance Rated, Direct-Hung, Double-Web Suspension System, DSA Approved Ceiling System Donn DX/DXL24: USG Interiors, 'Donn DX/DXL24 for main runner, with DX-216, 416, 424, or 524 cross runners, "Intermediate Duty".

### 2.2 COMPONENTS

A. General: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring Noise Reduction Coefficient (NRC): Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches away from the test surface) per ASTM E795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Acoustical Panel: USG Millenia® ClimaPlus™; Illusion Two/24 Panels; Item No. 78780.
      a. ASTM E1264, Type III, Form 1 or 2, Pattern G.
      b. Material: Mineral fiber.
      c. Surface Texture: Smooth texture.
      d. Surface Finish: White.
      e. Size: 24 inches by 48 inches.
      f. Thickness: 3/4 inch.
      g. Density: 1.04 pounds per square foot.
      h. Edge Profile: SLT Reveal, beveled edge for lay-in.
      i. Noise Reduction Coefficient: 0.70.
      j. Ceiling Attenuation Class: 35.
      k. Flame Spread: ASTM E1264; Class A; Flame spread 25; Smoke developed 25; (UL labeled).
      l. Light Reflectance: 85 percent.
      m. Recycled Content: 80 percent.
      n. Durability: Washable, Impact-Resistant, Scratch-Resistant, Soil-Resistant."

   2. Acoustical Linear Wood Plank Ceiling: Armstrong WoodWorks® Linear, Item 6440W1NMP.
      a. ASTM E1264 Classification: Composite – Fire Class A.
      b. Material: Fire retardant particle board with face-cut veneers. Factory-applied black fleece on each plank to cover the reveal.
      c. Dimensions: 8' x 3-3/4" x 3/4" with 3/4" reveal.
      d. Surface Finish: Clear.
      e. Acoustics NRC: 0.65.

f. Color: Natural Variations: Maple.
g. Fire Performance:
   1) ASTM E894 surface burning characteristics.
   2) HPVA Certified with audit program per ASTM E84.
   3) Flame Spread index 25 or less.
   4) Smoke Developed index 50 or less.
   5) ASTM E1264 Classification: Composite - Fire Class A.
h. Weight: 2.88 lbs/SF.
i. Accessories:
   1) 5843 – Linear Wood Splice.
   2) 5659W1NMP - 4" WoodWorks Trim (with aluminum substrate).
   3) RC2 – Radius Clip for faceted grid applications.
   4) 7805BL – 10' Angle Molding (Tech Black).
   5) 8200100 – Fiberglass Infill Panel (2' x 2' x 1" thick).

## 2.3 CEILING SUSPENSION SYSTEM

A. Components: All main beams and cross tees shall be commercial quality hot dipped galvanized steel as per ASTM A653. Main beams and cross tees are double-web steel construction with 15/16 inch type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
   1. Structural Classification: ASTM C 635, Heavy Duty.
   2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
   3. Acceptable Product: USG Donn/DX.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, prestretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.
   1. Perimeter wall molding: Minimum 2 inch flange.

E. Accessories:
   1. Light Fixture Protection and Hold Down Clips: Provide light fixture protection panels, fasteners and hold down clips as required by UL listing; manufacturer's standard types.
   2. Stabilizer bars, furring clips, splices, edge moldings, and seismic compression posts as required for suspended grid system.

F. Finish: Baked enamel finish on exposed surfaces. Flame spread: 76-200.

G. Carrying Channels and Hangers: Of black steel; size and type to suit application, seismic requirements, ceiling system flatness requirements, and to rigidly secure the complete acoustic unit ceilings with maximum deflection of 1/360.

H. Hanger Wires and Brace Wires: Size and location as specified and noted on drawings.

I. Hold Down Clips: Manufacturer's standard, use at all 24 by 24 inch acoustical panels.

J. Compression Struts: "Donn Compression Posts" manufactured by USG Interiors, Inc. Alternate Manufacturers: No known equal.

## 2.4 ACOUSTICAL SEALANT

A. As recommended by acoustical material manufacturer, for application shown.

## 2.5 METAL SUSPENSION SYSTEMS

A. Provide 12 gauge minimum hanger wires for use up to and including 4 feet by 4 feet grid spacing along main runners.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify layout of hangers will not interfere with other work.

B. Examine substrates and 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.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Environmental Requirements: Maintain temperature approximating operational conditions, before, during and after installation; humidity not more than 70 percent.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other Sections.

C. Measure each ceiling area and establish the layout of acoustical panel to balance border widths at opposite edges of each ceiling. Avoid using less than half width units at borders, and conform to the layout shown on reflected ceiling plans.

## 3.3 EXISTING WORK

A. Extend existing acoustical ceiling installations using materials and methods as specified.

B. Clean and repair existing acoustical ceilings which remain or are to be installed.

## 3.4 INSTALLATION

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Lay-In Grid Suspension System: Complying with IR 25-2:

1.1 #12 gage (min.) hanger wires may be used for up to and including 4 ft by 4 ft grid spacing and shall be attached to main runners.

1.2 Provide #12 gage hanger wires at the ends of all main and cross runners within 8 inches of the support or within 1/4 of the length of the end tee, whichever is least, for the perimeter of the ceiling area. End connections for runners which are designed and detailed to resist the applied horizontal forces may be used in lieu of the #12 gage hanger wires subject to Division of the State Architect (DSA) review and approval.

1.3 Provide trapeze or other supplementary support members at obstructions to main hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb are to have counter-sloping wires.

1.4 Ceiling grid members may be attached to not more than 2 adjacent walls. Ceiling grid members should be at least 1/2 inch clear of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 1/2 inch clear of wall.

1.5 At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or a #16 gage wire with a positive mechanical connection to the runner may be used. Where the perpendicular distance from the wall to the first parallel runner is 12 inches or less, this interlock is not required.

1.6 Provide bracing assemblies consisting of a compression strut and four #12 gage splayed bracing wires oriented 90 degrees from each other at the following spacing: .

a. Place sets of bracing wires at a spacing not more than 12 feet by 12 feet on center.

b. Provide bracing assemblies at locations not more than 1/2 the spacing given in paragraph 1.6.a above, from each perimeter wall and at the edge of vertical ceiling offsets.

The slope of these wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut. Splices in bracing wires are not to be permitted without special DSA approval.

c. Suspended acoustical ceiling systems with a ceiling area of 144 square feet or less, and fire rated suspended acoustical ceiling systems with a ceiling area of 96 square feet or less, surrounded by walls which connect directly to the structure above, do not require bracing assemblies when attached to two adjacent walls.

c. Provide a compression strut, steel section with L/R ratio of 200 maximum at each set of splayed wires, attach to main runner with 1/2 inch diameter machine bolt and to structure with #12 x 4 inch long. Compression strut shall not replace hanger wire.

1.7 Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the anchor aligns as closely as possible with the direction of the wire. Note: Wire turns made by machine where both strands have been deformed or bent if wrapping can waive the 1-1/2 inch requirement, but the number of turns should be maintained, and be as tight as possible.

1.8 Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc.

1.9 When drilled-in concrete anchors or shot-in concrete anchors are used in reinforced concrete for hanger wires, 1 out of 10 must be field tested for 200 lbs. in tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 must be field tested for 440 lbs. in tension. Shot-in anchors in concrete are not permitted for bracing wires. If any shot-in or drilled-in anchor fails, see CBC, Section 1023A.3.5.

1.10 Attach all light fixtures and ceiling mounted air terminals, to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures. Screws or approved fasteners are required.

1.11 Flush or recessed light fixtures and air terminals, weighing less than 56 pounds, may be supported directly on the runners of a heavy duty grid system but, in addition, they must have minimum of two #12 gage slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. All 4 ft by 4 ft. light fixtures must have slack safety wires at each corner.

a. All flush or recessed light fixtures and air terminals weighing 56 pounds or more must be independently supported by not less than 4 taut #12 gage wires each attached to the fixture and to the structure above regardless of the type of ceiling grid system used.

b. The 4 taut #12 ga. wires including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.

1.12 All fixtures and air terminals supported on intermediate duty grid systems must be independently supported by not less than 4 taut #12 gage wires each attached to the fixture or terminal, and to the structure above.

1.13 Support surface mounted light fixtures by at least two positive devices which surround the ceiling runner and which are each supported from the structure above by a #12 gage wire. Spring clips or clamps that connect only to the runner are not acceptable.

a. Provide additional supports when light fixtures are 8 feet or longer.

1.14 Support pendant mounted light fixtures directly from the structure above with hanger wires or cable passing through each pendant hanger and capable of supporting 4 times the weight of the fixture. A bracing assembly, per Figure 1 in IR 25-2, is required where the pendant hanger penetrates the ceiling. Specialty details are required to attach the pendant hanger to the bracing assembly to transmit horizontal forces.

C. Additional Requirements for Fire Rated Ceilings:

1. Provide Underwriter Laboratory (U.L.) design number or State Fire Marshal (SFM) listing number. The components and installation details must conform in every respect with the U.L. or SFM approval for the design number specified. Custom designs which combine components from different approved designs but have not been tested as a complete assembly are not acceptable.
2. For Schools and Essential Services Buildings, bracing assemblies are required for each 96 square feet. The first bracing assembly is required not more than 4 feet from each wall. A minimum of one bracing assemble is required between any two adjacent expansion cut-outs on runners being braced.
3. Pop rivets, screws, or other attachments are not acceptable unless specifically detailed on the drawings and approved by U.L. and SFM.

D. Additional Requirements for Metal Panels:

1. Metal panels and panels weighing more than 1/2 psf, other than acoustical tile, are to be positively attached to the ceiling suspension runners.

E. Acoustical Panels: Install acoustical panels in coordination with suspension system. Place splines or suspension system flanges into kerfed edges so that panel-to-panel joints are closed by double lap of material.

1. Fit adjoining panel to form flush, tight joints. Scribe and cut panel for accurate fit at borders and around penetrations through panel.
2. Hold panel field in compression by inserting leaf-type, spring-steel spacers between panel and moldings, spaced at 12 inches on center.

3. Ceiling installer shall protect lighting fixtures and air ducts to comply with requirements indicated for fire resistance rated assembly.
4. Install hold-down clips within 20 feet of exterior doors to retain panels tight to grid system.

F. Edge Moldings and Trim: Unless otherwise noted, install edge moldings and trim of type indicated at perimeter of acoustical panel ceiling area and where necessary to conceal edges of acoustical units.
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 over 16 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8-inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

## 3.5 ADJUSTMENT

A. General: Adjust sags or twists which develop in ceiling systems; replace improperly installed or damaged suspension system components and acoustical panels, as directed by the Architect.

## 3.6 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

## 3.7 CLEANING

A. Section 01 74 00 – Cleaning: Final cleaning.

B. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

**END OF SECTION**

# SECTION 09 65 00

# RESILIENT FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section include the following:
1. Linoleum Tile Flooring.
2. Heavy Duty Resilient Tile Flooring.
3. Resilient Sheet Safety Flooring.
4. Resilient base.
5. Installation accessories.
6. Calcium chloride concrete moisture testing.

B. Related Sections
1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 07 26 00 – Concrete Vapor Control Barrier.

### 1.2 REFFERENCES

A. ADAAG - Americans with Disabilities Act (ADA):
1. Accessibility Guidelines for Buildings and Facilities.

B. ASTM International:
1. ASTM C662 - Smoke Density Test.
2. ASTM D2047 - Static coefficient of friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
3. ASTM E648/NFPA 253 – Standard Test Method for Critical Radiant Flux of Floor-Covering Systems using a Radiant Heat Energy Source.
4. ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
5. ASTM F710 – Standard Practice for Preparing Concrete Floors and other Monolithic Floors to receive Resilient Flooring.
6. ASTM F970 – Standard Test Method for Static load limit.
7. ASTM F1066 - Specification for Vinyl Composition Floor Tile.
8. ASTM F1303, Standard Specification for Sheet Vinyl Floor Covering with Backing.
9. ASTM F1482 - Preparation for installation of Resilient flooring wood subfloors.
10. ASTM F1861 - Wall Base: Rubber and Vinyl Plastic.
11. ASTM F1869 - Standard test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
12. ASTM F2034 - Standard Specification for Sheet Linoleum Floor covering.
13. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
14. ASTM F2195 – Standard Specification for Linoleum Floor Tile.

C. Bay Area Air Quality Management District: www.baaqmd.gov
1. BAAQMD 8-51 – Regulation 8, Rule 51 – Adhesive and Sealant Products.

D. CCR - California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

E. Federal Specifications:
1. FS RR-T-650 – Treads, Metallic and Non-metallic, Non-skid.

2. FS SS-T-312b – Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.

F. National Fire Protection Association:
1. NFPA 253 – Test Method for Critical Radiant Flux of floor covering Systems Usng a Radiant Energy Source.
2. NFPA 258 – Recommended Practice for Determining Smoke Generation of Solid Materials.

G. Calcium Chloride Test developed by the Rubber Manufacturer's Association.

H. ISO 9001:2000 Certification

I. ISO 14001:2004 Certification

## 1.3 PERFORMANCE REQUIREMENTS

A. Provide slip resistant sheet vinyl safety flooring which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

B. Provide heavy duty dolce tile flooring which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

## 1.4 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's product data and installation instructions for each type of resilient flooring and accessories as proof of specification compliance.

C. Resilient Sheet Safety Flooring Shop Drawings: Submit shop drawings to indicate materials, details, and accessories, including but limited to the following:
1. Submit a cut diagram indicating seam locations and roll direction. Use mitered seam layouts for corners when changing directions 180 degrees (e.g. when running material down corridors which bisect at a right angle), unless approved otherwise.

D. Heavy Duty Dolce Tile Flooring Shop Drawings: Submit shop drawings showing layout, profiles and product components, including, accessories, finish colors, patterns and textures.

E. Samples: Submit 3 sets of samples of each type, color and finish of resilient flooring and accessory required, indication full range of color and pattern variation as proof of specification compliance.

F. Resilient Sheet Safety Flooring Quality Assurance Submittals: Submit the following:
1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Manufacturer's Instructions: Current published manufacturer's installation and maintenance instructions.
3. Manufacturer's Field Reports: Manufacturer's field reports specified herein.

G. Warranty: Warranty documents specified herein.

H. Flame Spread Certification: Submit manufacturer's certification that resilient flooring furnished for areas indicated to comply with required flame spread rating has been tested and meets or exceeds indicated standard.

## 1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Contract Closeout: Closeout Procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing. Include precautions against cleaning materials and methods detrimental to finishes and performance.

## 1.6 QUALIFICATIONS

A. Manufacturer: Whenever possible, provide each type of resilient flooring and accessories as provided by a single manufacturer, including recommended primers, adhesives, sealants, finish accessories and leveling compounds.

B. Flooring Contractor:
   1. Flooring Contactor shall be an established firm, experienced in the installation of the specified product and shall have access to all manufacturer's required technical, maintenance, specifications and related documents.
   2. Flooring Contractor shall have completed at least three projects of similar magnitude, material and complexity, and must provide project reference details including contact names and telephone numbers.

C. Installer Qualifications: Installer experienced in performing work of this section who is specialized in installation of work similar to that required for this project.
   1. Resilient Sheet Safety Flooring Installer and Altro Dolce Tile Installer: Installer who has attended an Altro installation training clinic.

## 1.7 QUALITY ASSURANCE

A. Regulatory Requirements: Provide slip resistant sheet vinyl safety flooring in compliance with the following:
   1. Americans with Disabilities Act Architectural Guidelines (ADAAG).
   2. Occupational Safety & Health Administration (OSHA).

## 1.8 MOCKUP

A. Standard of Quality: For the purpose of evaluating the quality of workmanship, a mock up installation of the specified floor coverings shall be provided by the flooring contractor.

B. Construct mockup, minimum 10 feet by 10 feet.

C. Locate where designated by Architect.

D. Upon approval, this test installation shall then be considered the standard of quality and basis of comparison for the balance of the project.

E. Incorporate accepted mockup as part of Work.

F. Areas found to be deficient by specification standards or application procedures shall be repaired/replaced at contractor's expense.

## 1.9 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Pre-installation Meetings.

B. Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

## 1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at a temperature and humidity conditions recommended by manufacturer.
   1. Move resilient flooring and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by the manufacturer.

## 1.11 PROJECT CONDITIONS

A. Substrate Conditions: Use the method described below to determine the dryness as required to ensure initial and long term success.
   1. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride:
      a. This test method covers the quantitative determination of the rate of moisture vapor emitted from below-grade, on-grade, and above-grade (suspended) concrete floors.
      b. Conduct one calcium chloride test for every 1,000 square feet (minimum 3 tests) to ensure concrete moisture emissions do not exceed 3 lbs per 1,000 square feet within a 24-hour period.
   2. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Slab Using in situ Probes:
      a. This test method covers the quantitative determination of percent relative humidity in concrete slabs for field or laboratory test.
      b. Conduct one test for every 1,000 square feet (minimum 3 tests) to ensure concrete does not exceed 85 percent internal relative humidity.
   3. Alkalinity Testing: ASTM F710 Maximum pH of 9.0.

B. General Contractor shall be responsible for insuring independent inspection of items 1, 2 and 3 above. Contractor shall verify in writing to Owner and subcontractor, a minimum of thirty (30) days prior to scheduled resilient flooring installation, the following substrate conditions: Reference Section 01 45 23 – Testing and Inspection.

C. Contingency for High Moisture Readings: If at the time of testing the moisture readings are in excess of manufacturer's recommendations the Contractor will initiate testing using petrographic core analysis to determine if the Water/Cement Ratio and sufficient hydration has taken place. If the Specifications were not followed in their entirety, water/cement ratio (as specified), and or the concrete surface has been inadequately hydrated the Contractor responsible for the placement of the cement shall be responsible for the costs associated with the petrographic analysis and subsequent remediation requirements.

D. Moisture Remediation: Basic Steps as follows:
   1. Removal of all floor coverings, adhesive residue, curing compounds, parting compounds or other surface contaminants by mechanical means ( shot-blasting, or other suitable method).
   2. Identification and treatment of all cracks and joints, by the sealer manufacturer's approved methods.
   3. Application of the sealer (Must be a product designed and warranted for the purpose of controlling excessive concrete moisture vapor emission and the alkali it may carry).

4. Application of a sacrificial cementitious topping to act as a substrate for the installation of resilient floor coverings.

E. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations. Areas to receive flooring shall be clean, fully enclosed, weather tight with the permanent HVAC set at a uniform temperature of at least 68 degrees F 72 hours prior to and during and for not less than 48 hours after installation. The flooring material should be conditioned in the same manner.

F. Close spaces to traffic during resilient flooring installation and for time period after installation recommended in writing by the manufacturer.

G. Install resilient flooring material and accessories after other finishing operations, including painting, have been completed.

H. Where demountable partitions and other items are indicated for installation on top of sheet resilient flooring material, install flooring material before these items are to be installed.

## 1.12 WARRANTY

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. Manufacturer's Warranty: Submit manufacturers standard warranty document.

C. Warranty Period for Linoleum Tile: Five (5) year limited warranty commencing on date of Substantial Completion.

D. Warranty Period for Resilient Sheet Safety Flooring: Seven (7) years commencing on Date of Substantial Completion.

D. Warranty Period for Heavy Duty Dolce Tile Flooring: Ten (10) years commencing on Date of Substantial Completion.

## 1.13 MAINTENANCE

A. Perform maintenance of finished linoleum tile flooring per Tarkett maintenance guide.

## 1.14 EXTRA MATERIALS

A. Section 01 77 00 – Contract Closeout: Spare parts and maintenance products.

B. Deliver to owner extra materials from same production run as Products installed. Package products with protective covering and identify with descriptive labels.
1. Quantity: Furnish 50 square feet of flooring and 20 lineal feet of base of each type and color specified.
2. Clearly identify each roll of sheet flooring.
3. Delivery, storage and protection: Comply with owner's requirements for delivery, storage and protection of extra materials.

# PART 2 - PRODUCTS

## 2.1 LINOLEUM TILE FLOORING

A. Manufacturers:

1. Tarkett Linoleum Tile, as supplied by Compass Concepts, 2200 East Artesia Blvd., Long Beach, CA 1-800-543-6033; wwww.tarkett.com.
2. Forbo Industries, Inc.; www.forbo-industries.com.
3. Substitutions: Section 01 60 00 – Product Requirements: Product options and substitutions.

B. Product Description: Tarkett Linoleum Tile:
1. ASTM F2034, Type 1 Exceed requirements for linoleum tile flooring
2. Size: 50 cm (19.68 inches) x 50 cm (19.68 inches).
3. Gauge: 2.5 mm (0.10 inch).
4. Content: Linoleum marbleized linoleum consists of 1 homogeneous layer of oxidized linseed oil and natural resins mixed with wood or cork-flour, limestone and pigments affixed to a jute backing. The marbleized pattern extends evenly throughout the total thickness on a polyester backing.
5. Flammability exceeds minimum for Class 1 per ASTM E648.
6. Smoke density less than 450 per ASTM E-662
7. Static Coefficient of Friction of 0.6 on level surfaces per ASTM D 2047 James slip test.
8. Meets or exceeds static load limit of 500 psi per ASTM F 970 modified.
9. ISO 9001:2000 Certification.
10. ISO 14001:2004 Certification.
11. Colors and Patterns: As selected by Architect from manufacturer's standard selection.

C. Upon request by Architect, Flooring manufacturing to provide independent testing labs verification of all applicable test results.

## 2.2 SAFETY FLOORING

A. Manufacturers:
1. Altro Safety Flooring Systems; www.altrofloors.com
2. Substitutions: Not permitted; District standard.

B. Slip Resistant Sheet Vinyl: Conform to ASTM F1303, Type 2, Grade 1, sheet vinyl flooring with moisture resistant backing Class A. Static coefficient of slip resistance in excess of 0.6 when tested in accordance with ASTM D2047, AltroSan™ integrated bacteriostat; color as selected by Architect.

C. Product Description: Altro Maxis Suprema.
1. Color: SU2009 Minerva:
2. Thickness: 0.08 inch (2.0 mm).
3. Roll Width: 6' - 7" (2 m).
4. Roll Length: 66 feet (20 m).
5. Roll Weight: 220 lb (100 kg).
6. Slip Resistance (Dry): 0.6.

D. Accessory Products: Provide accessories for use with Altro safety flooring.
1. Vinyl welding rod: Acceptable material:
   a. Altro weld rod
2. Cove former: Acceptable material, sized to suit application:
   a. Altro Cove former 20R - 24 mm (1") radius.
3. Cap strip: Acceptable material, sized to suit application, [Vinyl] [stainless steel]:
   a. Altro Cap Strip [C4] [C7] [C8] [C11].
4. Joint cover strip: Acceptable material, vinyl, sized to suit application:
   a. Altro Joint Cover Strip [EJC75/20] [EJC50/20] [EJC75/32].
5. Acrylic Adhesive: For dry areas with no spillage, use Ecofix, a one-part, water-based, acrylic adhesive as recommended by manufacturer.

6. Polyurethane Adhesive: For areas subjected to spillage, extreme temperature changes or heavy rolling loads, use Altrofix 30 or 300, a two-part resin-based polyurethane adhesive.
7. Subfloor Filler and Leveler: Use only gray Portland cement-based underlayments, and patching compounds. Use for filling cracks, holes or leveling. White gypsum materials are not acceptable. Contact Altro for more information and recommendations.
8. Metal edge strips:
    1. Aluminum extruded, smooth, [mill finish] stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

## 2.3 DOLCE TILE FLOORING

A. Manufacturer:
1. Altro; www.altrofloors.com.
2. Substitutions: Section 01 60 00 – Product Requirements: Product options and substitutions.

B. Product Description and Basis of Design: Altro Dolce Tile, a homogenous high-performance enhanced vinyl tile suitable for a wide range of applications.
1. Thickness: 0.12 inch (3.0 mm).
2. Size: 18 inch x 18 inch.
3. Weight: 41.9 lbs per box.
4. Colors:
    a. Resilient Flooring 5 (Field): AD514.
    b. Resilient Flooring 6 (Accent): AD515.

C. Proprietary Product(s) Standard and Testing:
1. Fire Resistance: Flammability Resistance exceeds minimum for Class 1 rating per ASTM E648.
2. Smoke Density: Less than 450 when tested in accordance with ASTM E662.
3. Slip Resistance: Altro Dolce Tile meets and exceeds current published slip resistance requirements of OSHA. Tests were performed in accordance with ASTM D2047 for dry conditions.

## 2.4 RESILIENT BASE

A. Manufacturers:
1. Burke Mercer.
2. Substitutions: Not permitted; District Standard.

B. Base: ASTM F1861, Group 1 rubber; Type TS (vulcanized thermoset rubber) Style B (coved) as shown on drawings; top set.
1. Height: 4 inch.
2. Thickness: 0.125 thick.
3. Finish: Matte.
4. Length: Roll.
5. Accessories: Premolded external corners, internal corners, and end stops.
6. Color: Black Brown 523.

## 2.5 EDGING STRIPS

A. General: Specified products are manufactured by BurkeMercer Products Co., Inc.; color as selected by Architect.

B. Alternate Manufacturer: Comparable products manufactured by the Johnsonite Division of Duramax, Inc., or accepted equal.

C. Resilient Flooring to Carpet: Model No. 152 or Model 710.

D. Resilient Flooring to Concrete: Model No. 170.

E. Tile Reducer: Model No. 633 Tile Reducer.

## 2.6 ACCESSORIES

A. Trowelable Underlayments and Patching Compounds: Latex modified, portland cement based formulation provided or approved by resilient flooring manufacturer for applications indicated.

B. Primers: Waterproof; types recommended by flooring manufacturer.

C. Adhesives: Provide manufacturers recommended adhesive as required by project conditions.
   1. Adhesive for Linoleum Tile: Ecofix 25.

D. Adhesives (Cements): Moisture and alkali resistant, type recommended by tile manufacturer to suit resilient floor tile products and substrate conditions indicated.

E. Metal Edge Strips: Of width shown and of required thickness to protect exposed edge of resilient flooring. Provide units of available length, to minimum number of joints.

F. Filler for Coved Base: Plastic.

G. Sealer and Wax: Types recommended by flooring manufacturer.

H. Accessory Products for Installation of Altro Dolce Tile:
   1. Acrylic Adhesive: Ecofix 25 for adhering flooring to substrate.
   2. Polyurethane Adhesive: Altrofix 31 for adhering flooring to substrate.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Installer must examine areas and conditions under which resilient flooring and accessories are to be installed and must notify General Contractor in writing of conditions detrimental to proper and timely completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner and Architect.

## 3.2 PREPARATION

A. Surface Preparation - Linoleum Tile Flooring:
   1. Concrete floors shall be constructed in accordance with the American Concrete Institute ACI 302.1 R-95 Guide for concrete floor and slab construction.
   2. Floors must be finished and cured according to ACI with a minimum compressive strength of 3500 psi.
   3. Floors must be clean, dry and smooth. Any surface materials, such as paint, wax, grease, oil, adhesive residues, etc. must be removed. Floors must be free of any sealers, curing, hardening or parting compounds that would adversely affect the adhesive used with the flooring. Refer to ASTM F 710 standard practice for preparing concrete floors and other monolithic floors to receive resilient flooring.

4. A moisture barrier shall be installed prior to pouring of on- or below-grade slabs. Moisture vapor transmission shall not exceed 3 lbs./1,000 sq. ft./24hours, per ASTM F1869 Calcium Chloride Test.
5. Maintain room temperature, adhesive and flooring material at 68 - 72 degrees F for 72 hours before during and after installation.
6. Broom clean or vacuum surfaces to be covered and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.

B. Subfloor Preparation - Resilient Sheet Safety Flooring:
1. Remove ridges and bumps.
2. Apply subfloor filler to low spots and cracks to achieve floor level to a tolerance of 1:1000, allow to cure. Never install Altro flooring over gypsum-based toppings, underlayments, leveling or patching compounds.
3. Meet ASTM F710 Standard for Concrete or other monolithic floors.
4. Prepare and seal porous and powdery concrete surfaces in accordance with flooring manufacturer's written instructions.
5. Ensure concrete slopes to drains and other floor sinks.
6. Remove dust, old adhesive, paint, dirt, wax, sealer and foreign matter from existing surfaces.

C. Surface Preparation - Resilient Sheet Safety Flooring:
1. Safety flooring shall be installed over subfloors conforming to ASTM F710 for concrete and other monolithic floors.
2. Maintain air temperature and structural base temperature at flooring installation area between 65 degrees F and 80 degrees F for 48 hours before, during and 24 hours after installation.
3. Perform moisture tests on concrete floors regardless of the age or grade level. Verify concrete substrate is dry in accordance with the RFCI Industry Standards Slab Moisture Test Method (Calcium Chloride Method), in strict accordance with instructions.
4. Perform moisture condition test in each major area. A minimum of 1 test per 1000 sq ft, prior to installation. Moisture emissions from concrete subfloors must not exceed 3 lbs per 1000sf per 24 hours for acrylic adhesive and 5lbs for polyurethane adhesive via the Calcium Chloride Test Method (ASTM F1869). If subfloor moisture exceeds the allowable maximum for installing Altro flooring, please call your local Altro distributor for advice.
5. Conduct moisture tests around room perimeter, at columns and where moisture may be evident.
6. Perform alkali tests to ensure pH levels of concrete subfloor surface do not exceed pH 9.9. Concrete must be neutralized if above pH 9.9.
7. Do not proceed with work until results of moisture condition and/or pH tests are acceptable.
8. Underlayment and Patching Compounds: Use only grey colored Portland cement based underlayments; patching compounds are used for filling cracks, holes and leveling. White gypsum materials are not acceptable.

D. Surface Preparation – Dolce Tile Flooring:
1. Install Dolce Tile flooring over subfloors conforming to ASTM F710 for concrete subfloors.
2. Moisture Testing: Moisture emissions from concrete subfloors must not exceed 5 lbs per 1000sf per 24 hours via the Calcium Chloride Test Method (ASTM F1869) and not to exceed 85% internal concrete relative humidity as tested in accordance with ASTM F2170-02. If subfloor moisture exceeds the allowable maximum for installing Altro Dolce Tile, please call your local Altro distributor for advice.

3. The pH level of the subfloor surface shall not be higher than 9.9. If higher, subfloor must be neutralized.
4. Underlayment and Patching Compounds: Use only gray colored Portland cement based underlayments; patching compounds are used for filling cracks, holes and leveling. White gypsum materials are not acceptable.

## 3.3 INSTALLATION – LINOLEUM TILE

A. Install in accordance with manufacturers written instructions

B. Mix tile from container to ensure shade variations are consistent when tile is placed.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints parallel to building lines to produce symmetrical tile pattern.

F. Install tile in checkerboard fashion with grain reversed in adjacent tiles. Allow minimum 1/2 full size tile width at room or area perimeter.

G. Finish Flooring Patterns: As selected by Architect.

H. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

J. Install flooring in recessed floor access covers. Maintain floor pattern.

## 3.4 INSTALLATION – RESILIENT SHEET SAFETY FLOORING

A. Safety Flooring Installation: Install Altro safety flooring in accordance with the current published Altro Installation Guide. Seams shall be heat welded with Altro Weldrod™ only. Failure to install Altro safety flooring in accordance with recommended procedures will void the Altro Limited Product Warranty.

B. Drains: Fit Altro safety flooring and mechanically fasten to drain outlets to ensure a permanent, watertight installation.
1. New Round Drains: Install round flash clamping ring type drains to accommodate Altro safety flooring. Install drains to fit flush with surrounding floor surface. Acceptable drain manufacturers and drain types include Wade FC-1100. Please refer to Altro's current Installation Guide for approved drain manufacturers and styles.
2. Existing Drains: When existing drains are to be used, provide mechanically fastened stainless steel drain rings over all round drain outlets. Fit rings over slip resistant sheet vinyl safety flooring and permit inside diameter that will allow clean out plate to be removed after installation. Drill into concrete to accommodate lead or plastic anchors. Screw drain rings to create a tight seal with beveled head stainless steel screws.
3. Square and Rectangular Drains and Floor Sinks: Install Altro Gully Edge GE25RE or GE35RE around perimeter of drain which has been set in concrete in accordance with Altro Installation Guide. Do not use Altro Gully Edge around drains set in wood floors. Provide stainless steel strips, mechanically fastened with stainless steel screws. Use stainless steel strips in other areas where it is not practical to use Altro Gully Edge.

C. Coved Installation: Where Altro safety flooring is coved up wall surfaces and other abutments, installation shall be in accordance with Altro safety flooring Installation Guide using the following accessories:
   1. At standard wall finishes: Use Altro C7 vinyl cap strip to accommodate sheet vinyl to a height as indicated; adhere with contact adhesive.
   2. At ceramic tile, Altro Whiterock semi-rigid wall cladding or FRP paneling: Use Altro C8 Vinyl Captile Strip.
   3. At 0.75 inch radius coving at juncture of vertical and horizontal surfaces: Use Altro Vinyl Cove Former 20R: install with contact adhesive.
   4. Top set cove base: Install in accordance with manufacturer's instructions.
   5. Reducer strip - Reducer strip GE25RE/GE35RE where Altro safety flooring will not adjoin other materials or surfaces.

## 3.5 INSTALLATION – DOLCE TILE

A. Install Altro Dolce Tile in accordance with the current published Altro Installation Guide. Failure to install Altro Dolce Tile in accordance with recommended procedures will void the Altro Limited Product Warranty.

## 3.6 INSTALLATION - BASE

A. Fit joints tight and make vertical. Maintain minimum measurement of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

D. Install base on solid backing. Bond tight to wall and floor surfaces.

E. Scribe and fit to door frames and other interruptions.

F. Install base at casework where occurs in rooms scheduled for rubber base.

## 3.7 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner and Architect requests, and with sufficient notice, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
   1. Site Visits: Minimum one site visit, duration of 1 - 2 hours, or as needed to conduct thorough inspection.

## 3.8 CLEANING

A. Section 01 74 00 – Cleaning: Final cleaning.

B. Dispose of all containers in a legal manner.

C. Follow manufacturers written recommendations for cleaning and routine maintenance.

## 3.9 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

B. Remove and legally dispose of protective covering at time of substantial completion.

**END OF SECTION**

# SECTION 09 68 16

# SHEET CARPETING

## PART 1 – GENERAL

### 1.1 SUMMARY

A. Section Includes carpet direct glued to substrate; carpet; and accessories.

B. Related Sections:
1. Section 09 65 00 – Resilient Flooring: Base finish.
2. Section 09 65 00 – Resilient Flooring: Termination edging of adjacent floor finish.
3. Section 26 01 00 – Basic Materials and Methods: Electrical floor cover plate with recess for carpet.

### 1.2 REFERENCES

A. American Association of Textile Chemists and Colorists (AATCC):
1. AATCC 16 – Test Method for Colorfastness to Light
2. ATCC 134 – Test Method for Electrostatic Propensity of Carpets.

B. ASTM International:
1. ASTM C1028 – Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
2. ASTM D1335 – Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
2. ASTM D1667 – Standard Specification for Flexible Cellular Materials – Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
3. ASTM D3936 – Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.
4. ASTM D5116 – Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
5. ASTM D5417 – Standard Practice for Operation of the Vetterman Drum Tester.
6. ASTM E648 – Test Method for Critical Radiant Flux of Floor Covering Systems using a Radiant Heat Energy Source.
7. ASTM E662 – Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

C. Consumer Products Safety Commission:
1. CPSC FF 1-70.
2. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.

D. National Fire Protection Association:
1. NFPA 253 – Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.
2. NFPA 258 – Standard Method of Test for Smoke Density.

E. South Coast Air Quality Management District:
1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

### 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate the extent of carpet, seam direction of carpet, and accessories. Indicate columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet. Copy of approved shop drawings to be available on job site during installation.

C. Carpet schedule using same room designations indicated on drawings.

D. Product Data: Submit data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.

E. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial color selection.

F. Verification Samples: Submit two 18" x 18" samples illustrating color and pattern for each carpet material specified.

G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

H. Warranty.

## 1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Contract Closeout: Closeout procedures.

B. Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

## 1.5 QUALIFICATIONS

A. Manufacturer:
1. Company specializing in manufacturing specified carpet/backing with minimum 5 years documented experience.
2. Upon request, manufacturer to provide representative to assist in project start-up and to inspect installation while in process and upon completion. Representative will notify designated contact if any installation instructions are not followed.
3. Single Source Responsibility: Obtain each type of carpet from one source and by a single manufacturer.

B. Installer:
1. Flooring contractor must be certified by the carpet manufacturer prior to bid.
2. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.
3. Flooring contractor possessing Contract for the carpet installation shall not sub-contract the labor without written approval of the Project Manager.
4. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the carpet manufacturer and PROJECT CONDITIONS herein.
5. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

## 1.6 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.

B. Store in a dry location, between 60 degrees F and 80 degrees F and a relative humidity below 65 percent. Protect from damage and soiling. Stack carpet rolls horizontally on a flat surface, stacked no higher than two rolls.

C. Make stored materials available for inspection by the Owner's representative.

D. Store materials in area of installation for minimum period of 48 hours prior to installation.

## 1.8 PROJECT CONDITIONS

A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.

B. The maximum permissible amount of water vapor emission from the floor is 3.0 pounds per 1,000 square feet in 24 hours. The acceptable pH level of the substrate is between 7.0 and 9.0. Flooring contractor is responsible for floor testing.

C. All material used in sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.

D. Maintain minimum 65 degrees F ambient temperature and 65 percent Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

E. Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

## 1.9 EXTRA MATERIALS

A. Provide additional 3 percent of each type, color, and pattern furnished; product to be rolled and bound. Coordinate storage location with owner.

B. Deliver all unused carpet and large scraps to Owner for "attic stock." Dispose of scraps less that 2 square foot in area or less than 8 inches in width.

## 1.10 WARRANTY

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

C. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.

D. Chair Pads are not required for carpet warranty coverage.

E. Warranty shall not exclude carpet product installed on stairs provided it is properly installed and maintained.

F. Warranty shall be for a minimum non-prorated period of twenty-five years and shall cover against
1. Excessive Surface Wear: More than 15 percent loss of pile fiber weight.
2. Excessive Static Electricity: More than 3.0 kV per AATCC 134.
3. Resiliency Loss of the Backing: More than 10 percent loss of backing resiliency.
4. Delamination.
5. Edge Ravel.
6. Zippering.

G. Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

H. Provide certification and warranty that product is fully or partially recyclable through manufacturer's or aligned partner's recycling program. Include information regarding what portions of the product will be recycled into other recyclable/non-recyclable products, down-cycled, landfilled, and/or incinerated.

## PART 2 – PRODUCTS

### 2.1 CARPET

A. Manufacturers:
1. Collins & Aikman Floorcoverings.
2. Substitutions: Not permitted. Specified product is District Standard.

### 2.2 FIBER

A. Nylon Fiber: Bulked Continuous Filament Type 6,6 Nylon.

B. Mill-extruded fibers are not allowed.

C. Blends of Solutia fibers are not allowed. Solutia LXI fibers alone are not allowed.

D. Durable stain inhibitor should be applied to the fiber during product manufacturing to resist fiber staining and soiling. Minimum average of three fluorine analyses of a single composite sample per CRI TM-102: 500 ppm.

E. Fiber to contain carbon-core filament for permanent static control. Topical treatments not allowed.

### 2.3 BACKING CHARACTERISTICS

A. Thermoplastic vinyl composite.

B. Primary Backing: Synthetic Non-Woven.

C. Pre-Coat (Fusion Coat): Sealant Vinyl

D. Secondary Backing: Closed-Cell, Vinyl Cushion backing system.
1. Density (ASTM D-1667): 18.5 lbs/cu ft +/- 5%.
2. Compression Set (ASTM D-1667): Max 10%.
3. Compression Deflection (ASTM D-1667): Min. 7 psi @ 25%; Max. 25 psi @ 25%
4. Impermeable to moisture and airflow.
5. Provide for a chemically welded seam that is also impermeable to moisture and airflow.
6. 6 feet Width Roll Goods.

E. Product to be installed with a mill-applied releasable "dry" adhesive system to securely attach product to sub-floor in compliance with ADA guidelines (Section 4.5.3) if available from Manufacturer. Free-lay, grid system, and stretch-in installations not allowed.

## 2.4 PERFORMANCE CHARACTERISTICS

A. Test reports for the following performance assurance testing to be submitted upon request. Submitted results shall represent average results for production goods of the referenced style.

B. Requirements listed below must be met by all products.

1. Flooring Radiant Panel:
ASTM E-648 / NFPA 253: Class 1 (CRF: 0.45 watts/sq cm or greater).

2. Federal Flammability:
CPSC FF 1-70: Passes.

3. Smoke Density:
ASTM E-662 / NFPA 258: < 450 Flaming Mode.

4. Electrostatic Propensity:
AATCC 134 (Step & Scuff): 3.0 kV or less.

5. Static Coefficient of Friction:
ASTM C-1028: Passes ADA Guidelines for Accessible Routes (Minimum 0.60).

6. Delamination of Secondary Backing of Pile Floor Coverings:
ASTM D-3936: No Delamination.

7. Lightfastness:
AATCC 16E: > 4 at 100 hours.

8. Vetterman Drum:
ASTM D-5417: Minimum 3 at 22,000 cycles.

9. Moisture Barrier:
Moisture Penetration by Impact at 10 psi: No Penetration of backing and seam after 10,000 impacts.

10. Air Flow Barrier:
Air Permeability of Textile Fabrics: No Air Flow (0.0 $ft^3$/min) through backing and seam.

11. Seam Integrity:
Seam to remain intact after 50,000 cycles per Phillips Chair Test.

12. VOC Chamber Testing:
ASTM D-5116: Product inclusive of "dry" adhesive system meets criteria established by the State of Washington Indoor Air Quality Specification for Carpet and/or Carpet & Rug Institute's (CRI) Indoor Air Quality Carpet Testing Program. If "dry" adhesive (2.02E) not available from manufacturer and "wet" adhesive is used to install the product, carpet and adhesive to meet CRI's Green Label requirements.

## 2.5 MANUFACTURING SPECIFICATIONS

A. Style: Odyssey Vinyl Cushion RS/ (Vinyl Cushion) - Mark I.

| | | |
|---|---|---|
| 1. | Colors: | 14520 – Ganymede (Carpet #1).<br>14510 – Kaleidoscope (Carpet #2). |
| 2. | Construction: | Loop |
| 3. | Gauge: | 1/13 inch |
| 4. | Pile Units per Inch: | 8.4 |
| 5. | Pile Height Average | 0.117 inch |
| 6. | Pile Yarn Weight | 20.0 oz/sq yd |
| 7. | Density Factor | 10,000 |
| 8. | Yarn Size | 1245/2 |
| 9. | Fiber System | 75% TDX SDN 25% TDX Nylon with Static Control and Ensure |
| 10. | Interliner | Spun Synthetic |
| 11. | Powerbond Backing System | 6 ft |
| | ▪ Fusion Coat | Sealant Vinyl |
| | ▪ Backing | Closed cell vinyl cushion |
| | ▪ Weight | 35.5 oz/sq yd |
| | ▪ Density | 18.5 lbs/cu ft |
| | ▪ Thickness | 0.156 inch |
| 12. | Total Weight | 81.0 oz/sq yd +/- 5 percent |
| 13. | Electrostatic Propensity | 1.4 K.V. or lower |
| 14. | Flooring Radiant Panel Test | Mean average critical radiant flux: 0.45 w/sq cm or higher |
| 15. | Smoke Density | Flaming: Mean average: 450 or lower |
| 16. | Flammability | Passes |
| 17. | Warranties | 25 year wear, delamination, edge ravel, static, zippering, loss of resiliency |

## 2.6 ACCESSORIES

A. Materials recommended by Manufacturer for patching, priming, chemically welding the seams, etc.

B. Adhesives: Products to be supplied with a pre-cured, mill-applied or other "dry" adhesive system (2.02E) when available. Otherwise, adhesive should be full spread, extremely low VOC in compliance with CRI Indoor Air Quality Adhesive Testing Program requirements, compatible with materials being adhered, as recommended by the Manufacturer.

C. Base, Carpet Edge, and Transition Strips: As specified in Section 09 65 00.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.

B. Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

C. Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.

D. There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

### 3.2 PREPARATION

A. Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.
   1. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation. (i.e. floor wax).
   2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.

### 3.3 INSTALLATION - GENERAL

A. Install product in accordance with Manufacturer's installation instructions.

B. Verify carpet match before cutting to ensure minimal variation between dye lots.

C. Layout carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic. Minimize cross seams.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.
   6. Check pattern repeat, if any, for matching during installation and possible waste factors in ordering required amounts.

D. Install carpet tight and flat on sub-floor, well-fastened at edges, with a uniform appearance.

E. Double-cut carpet seams with accurate pattern match. Make cuts straight, true, and unfrayed.

F. Chemically weld all seams with manufacturer's recommended seam sealer as stated in installation instructions. Make sure the seam is fully sealed.

G. Roll with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor.

H. Trim carpet neatly at walls and around interruptions.

I. Completed carpet is to be smooth and free of bubbles, puckers, and other defects.

## 3.4 CLEANING

A. Section 01 74 00 – Cleaning: Final cleaning.

B. Remove excess adhesive and/or seam sealer from floor and wall surfaces without damage.

C. Remove all rubbish, wrappings, debris, trimmings, etc. from site and dispose of properly.

D. Clean and vacuum carpet surfaces using a beater brush/bar commercial vacuum.

## 3.5 PROTECTION

A. After each area of carpet is installed, protect from soiling and damage by other trades.

**END OF SECTION**

# SECTION 09 90 00

# PAINTING AND COATING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.

B. Related Sections:
1. Section 05 50 00 - Metal Fabrications: Shop primed items.
2. Section 06 20 00 - Finish Carpentry.
3. Section 08 12 14 - Standard Steel Frames.
4. Section 08 13 14 - Standard Steel Doors.
5. Section 08 31 13 - Access Doors and Frames.
6. Section 09 21 16 - Gypsum Board Assemblies.
7. Section 23 00 00 - Basic HVAC Requirements.
8. Section 26 00 00 - Basic Electrical Requirements.

### 1.2 REFERENCES

A. Air Quality Management District:
1. AQMD – Air Quality Regulations.

B. ASTM International:
1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.

C. Master Painters and Decorators Association:
1. MPI (APL) – Master Painters Institute Approved Products List; current edition, www.paintinfo.com.
2. MPI (APSM) – Master Painters Institute Architectural Painting Specification Manual; 2004.

D. Painting and Decorating Contractors of America:
1. PDCA - Architectural Painting Specification Manual.

E. South Coast Air Quality Management District:
1. SCAQMD Rule 1113 – Architectural Coatings.

F. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.

G. U.S. Environmental Protection Agency:
1. 40 CFR 59, Subpart D – National Volatile Organic Compound Emission Standards for Architectural Coatings; current edition.

### 1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

## 1.4 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's printed product data on all coatings specified, including preparation and application instructions.

C. Certification by manufacturer that products comply with Contract Documents and are compatible with applicable substrates and with each other.

D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

E. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified. GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.

F. Samples:
   1. Submit two paper chip samples, 3 inch by 5 in size illustrating range of colors and textures available for each surface finishing product scheduled.
   2. Submit two painted samples, illustrating selected colors and textures for each color and system selected. Submit on white card stock, 8 inch by 10 inch in size.

G. Manufacturer's Installation Instructions: Submit special surface preparation procedures, and substrate conditions requiring special attention.

## 1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Contract Closeout: Closeout procedures.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

## 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Applicator: Company specializing in performing work of this Section with minimum three (3) years documented experience.

C. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by state and local regulations.

## 1.7 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F in ventilated area, and as required by manufacturer's instructions.

## 1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 65 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## 1.10 SEQUENCING

A. Sequence application to the following:
   1. Do not apply finish coats until paintable sealant is applied.
   2. Back prime wood trim before installation of trim.

## 1.11 EXTRA MATERIALS

A. Section 01 77 00 – Contract Closeout: Spare parts and maintenance products.

B. Supply 1 percent (1%) or a minimum of one (1) gallon of each color, type, and surface texture of paint installed. Store where directed.

C. Label each container with color, type, texture, and room locations, in addition to manufacturer's label.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURER

A. Products listed in Schedule establish a standard of quality and are manufactured by Kelly Moore, which is the District Standard.

B. Substitutions: Not permitted.

## 2.2 COMPONENTS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:

1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
2. For good flow and brushing properties.
3. Capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.

C. Patching Materials: Latex fillers as recommended by coatings manufacturer.

D. Fastener Head Cover Materials: Latex filler as recommended by coatings manufacturer.

## PART 3 - EXECUTION

### 3.1 SCOPE – SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in Article 3.9 and 3.10, indicated on the Drawings, and as follows:
1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
5. Paint all insulated and exposed pipes; conduit; boxes; insulated and exposed ducts; angers, brackets, collars and supports; mechanical equipment; electrical equipment occurring in finished areas, to match background surfaces, unless otherwise indicated.
6. Paint equipment, piping, conduit, and exposed duct work.
   a. Refer to Division 22, Division 23 and Division 26 for schedule of color coding of equipment, duct work, piping, and conduit.
7. Paint all mechanical and electrical equipment, including that which is factory-finished, exposed to weather or to view on the roof or outdoors.
8. Paint shop-primed mechanical and electrical items occurring in finished areas.
9. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
10. Paint interior surfaces of air ducts with flat, nonspecular black paint where visible through registers, grilles, or louvers.
11. Paint dampers exposed behind louvers, grilles to match face panels.
12. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

B. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
2. Items indicated to receive other finish.
3. Items indicated to remain naturally finished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

5. Anodized aluminum.
6. Polished and brushed stainless steel items.
7. Polished and brushed stainless steel, anodized aluminum, bronze, terne, and lead.
8. Acoustical materials.
9. Concealed piping, ductwork, and conduit.

## 3.2 EXAMINATION

A. Verify surfaces are ready to receive Work as instructed by product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

C. Test shop applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Plaster and Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors: 8 percent.

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

## 3.3 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, and similar fittings prior to beginning painting operations.

B. Correct defects and clean surfaces affecting work of this section. Sand all gloss finishes to sheen. Remove existing coatings that are flaking or otherwise in unacceptable condition to receive paint. Preparation or removal of coatings containing lead must be performed in accordance with all EPA and OSHA guidelines.

C. Seal with shellac or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.

D. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to dry.

E. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
1. Prepare concrete, concrete masonry block, cement plaster, and mineral fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove

glaze. If hardeners or sealers have been used to improve curing, use mechanical methods if recommended by paint manufacturer.

2. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
3. Determine alkalinity and moisture content of surfaces by performing appropriate tests as specified in the MPI Manual. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture is present.
4. Etch concrete as specified in MPI manual.

F. Concrete Floors to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

G. Asphalt Concrete Surfaces to be Painted: All surfaces must be cleaned free from grease, oil, dirt, mildew, stains and other contaminants that would cause adhesion problems. Remove loose, peeling or chalky paint by high-pressure washing or other appropriate methods. Surfaces must be completely dry before application.

H. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation by acid etching and solvent washing. Apply specified primer as soon as cleaned surfaces are dry.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

1. Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical or chemical methods as recommended as best practice by primer manufacturer.

J. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

1. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

M. Interior Wood Items to Receive Transparent Finish: Sand wood to obtain a uniform appearance before immediately starting work. Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

N. Exterior Wood to Receive Opaque Finish: Remove dirt and foreign matter. Patch knots, pitch pockets, and other surface imperfections with patching compound and seal with sealer recommended by paint manufacturer.

O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

P. Metal Doors to be Field-Finished: Prime metal door top and bottom edge surfaces.

## 3.4 EXISTING WORK

A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

## 3.5 APPLICATION

A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

C. Sand wood and metal surfaces lightly between coats to achieve required finish.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

F. Prime concealed surfaces of interior and exterior woodwork with primer paint.

G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

H. Finishing Mechanical And Electrical Equipment:
1. Refer to Division 22, Division 23, and Division 26 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
2. Paint shop primed equipment.
3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
5. Paint interior surfaces of air ducts (and convector and baseboard heating cabinets) visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles to match face panels.
6. Paint exposed conduit and electrical equipment occurring in finished areas.
7. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
8. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
9. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

## 3.6 FIELD QUALITY CONTROL

A. Inspect and test questionable coated areas in accordance with MPI Architectural Painting Specification manual.

## 3.7 CLEANING

A. Section 01 74 00 – Cleaning: Final cleaning.

B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

## 3.8 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

A. Metal Fabrications - Section 05 50 00 and 05 12 00: Exposed structural steel.

## 3.9 SCHEDULE - EXTERIOR SURFACES

A. Cast-in-Place Concrete:
   1. Acrylic Latex, Satin:
      a. 247 Acry-Shield 100% Acrylic Masonry Primer.
      b. 1245 Acry-Shield 100% Acrylic Exterior Low Sheen Finish.
   2. Elastomeric Coating:
      a. 247 Acry-Shield 100% Acrylic Masonry Primer.
      b. 1128 Kel-Seal 100% Acrylic Elastomeric Coating, Smooth.

B. Ferrous Metals (Steel – Shop Primed):
   1. Industrial Alkyd Finish:
      a. 1710 Kel-Guard Alkyd Rust-Preventative Primer.
      b. 1700 Kel-Guard Alkyd Rust-Preventative Gloss Enamel.

C. Galvanized Metal:
   1. Industrial Gloss Alkyd Finish:
      a. 1725 Acry-Shield 100% Acrylic Metal Primer.
      b. 1700 Kel-Guard Alkyd Rust-Preventative Gloss Enamel.

D. Galvanized Metal:
   1. Industrial Urethane Finish:
      a. KM-15 Chemical Mastic High Build Epoxy.
      b. KM-375 High Build Gloss Polyurethane Enamel.

E. Aluminum, Brass, other non-ferrous metals:
   1. Acrylic Finish:
      a. 1725 Acry-Shield 100% Acrylic Metal Primer.
      b. 1680 Dura-Poxy+ 100% Acrylic Gloss Enamel.

F. Pipes, Boilers and Stacks:
   1. Heat Resistant Aluminum Coating (minimum 1000 degree F).
      a. Thurmalox 245C Primer.
      b. Thurmalox 280C Aluminum Air Dry VOC Compliant Silicone Coating.

## 3.10 SCHEDULE – INTERIOR SURFACES

A. Gypsum Board:
   1. Flat Acrylic Latex Finish:
      a. 971 Acry-Plex Interior PVA Primer/Sealer.

b. 550 Acry-Plex Interior Acrylic Flat Wall Paint.

2. Low-Lustre Acrylic Latex Finish:
   a. 971 Acry-Plex Interior PVA Primer/Sealer.
   b. 1010 KM Professional Int. Acrylic Eggshell Enamel.

3. Semi-Gloss Acrylic Latex Finish:
   a. 971 Acry-Plex Interior PVA Primer/Sealer.
   b. 1650 Acry-Plex 100% Acrylic Semi-Gloss Enamel.

B. Wood Doors and Trim (natural finish):
1. Acrylic Varnish Finish.
   a. 2094 Kel-Thane II Waterborne Interior Clear Semi-Gloss Finish.
   b. 2094 Kel-Thane II Waterborne Interior Clear Semi-Gloss Finish.
   c. 2094 Kel-Thane II Waterborne Interior Clear Semi-Gloss Finish.

C. Ferrous Metal (doors, frames and miscellaneous metal):
1. Industrial Enamel.
   a. 5725 DTM Acrylic Primer/Finish.
   b. 5780 DTM Acrylic Gloss Enamel.

D. Ferrous Metal (exposed structural steel joists, beams and metal decks):
1. Industrial Semi-Gloss Acrylic Enamel:
   a. KM-15 Chemical Mastic High Build Epoxy.
   b. KM-375 High Build Gloss Polyurethane Enamel.

E. Galvanized Metals Including Ductwork:
1. Industrial Semi-Gloss Acrylic Enamel:
   a. 5725 DTM Acrylic Primer/Finish.
   b. 5785 DTM Acrylic Semi-Gloss Enamel.

## 3.10 SCHEDULE - COLORS

A. Paint colors to be from District standard color scheme.
1. Standard interior field paint color: Kelly Moore #27 Bone Semi-Gloss.

B. Scope includes 15 percent to 20 percent accent colors.

| Canada College Interior Paint Color Palette | | | | | |
|---|---|---|---|---|---|
| Color Description | Name | Kelly-Moore Control # | Product | Sheen | Notes |
| White | Bone | OW-27 | 1685 Durapoxy | Eggshell | Wall field color |
| White | Bone | OW-27 | 1685 Durapoxy | Semi-Gloss | Wall field color |
| Light green | Khaki Green | 06-439-SMT | 1010-333 | Eggshell | Accent color |
| Dusty orange | Terra Cotta | 06-442-SMT | 1010-333 | Eggshell | Accent color |
| Medium Purple | Wisteria | 99-1976-SSF | 1686 Durapoxy | Eggshell | Accent color; no 333 base in 1686. |
| Light Gray | Putty | 06-435-SMT | 1686-222 Durapoxy | Eggshell | Accent color |
| Medium Yellow | Indian Corn | 06-437-SMT | 1010-333 | Eggshell | Accent color |
| Dark Brown | Bronzetone | | Rustoleum | Semi-gloss | Interior/exterior door trim, other metal surfaces as approved. |

**END OF SECTION**

# SECTION 10 14 00

# SIGNAGE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes interior signs.

### 1.2 REFERENCES

A. ADA Standards for Accessible Design:
   1. ADA Accessibility Guidelines for Building and Facilities (ADAAG), (28CFR Part 36, Appendix A.)

B. American National Standards Institute:
   1. ANSI A-117.1.

C. CBC - California Building Code, 2007 Edition:
   1. CBC 1115B.6 – Identification Symbols: Restroom Door Signs.
   2. CBC 1117B.5 – Signs and Identification.
   3. CBC 1011.3 – Tactile Exit Signs.

### 1.3 SYSTEM DESCRIPTION

A. Design Requirements: Design Accessible Entrance Signs, Room Identification Signs, Toilet Room signs, Tactile Exit signs, Room Capacity Signs, and Miscellaneous Signs, as required by CBC.
   1. International Symbol of Accessibility: CBC 1117B.5.1 and sections as follows:
      a. Design: CBC 1117B.5.8.1 and Figure 11B-6.
      b. Color of Symbol: CBC 1117B.8.1.1.
   2. Braille: California Braille Grade 2, per CBC 1117B.5.6.
   3. Proportions of Letters and Numbers: CBC 1117B.5.3.
   4. Character Height: CBC 1117B.5.4.
   5. Contrast and Finish of Symbols: CBC 1117B.5.2.
   6. Raised Characters and Pictorial Symbol Signs: CBC 1117B.5.5.
      a. Letter Type: CBC 1117.B.5.5.1.
      b. Symbol Size: CBC 1117B.5.5.2.
      c. Pictorial Symbol Signs (Pictograms Nongeometric): CBC 1117B.5.5.3.
   7. Information Posted: CBC 1117B.5.8.1.3: Lobby signs.
   8. Mounting Location and Height: CBC 1117B.5.7.
   9. Doors to Men's and Women's Sanitary Facilities: Provide signs that comply with CBC 1115B.6.

### 1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with CBC and ADAAG requirements for signage.

B. Comply with SMCCCD Design Standard for Interior Building Informational Signage.

### 1.5 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.
   1. Sign Location: Provide Graphic Schedule and location plans to identify and locate all signs. Item numbers listed in the Graphic Schedule shall be found on location plans and shall identify locations of specific sign items.

C. Samples: Submit two full size sample signs of type, style, and color specified. If approved, the samples may be installed as part of the Work.
   a. Submit supplier's standard color chart for selection purposes and selected colors for verification purposes for dimensional letters.
   b. Submit one each full size sample of cut metal dimensional letters and cast metal dimensional letters, in selected color and finish.

D. Product Data: Submit manufacturer's product data describing materials and signs.

E. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

F. Operation and Maintenance: Provide the Owner with proper cleaning instructions required for continued maintenance of signs.

## 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Fabricator: Able to provide Scotch 3M3D sign systems.

## 1.7 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 Project Meetings: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

C. Pre-Installation Conferences: Sign locations shown on the location plans are for general information only. Prior to installation and as required, arrange meetings with the Architect at the site for final location for all sign items.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Package signs, labeled in name groups.

C. Store adhesive attachment tape at ambient room temperatures.

# PART 2 - PRODUCTS

## 2.1 SIGNS

A. Manufacturers:
   1. Action Signs.
   2. Fabricators able to provide Scotch 3M3D sign systems. No substitutions permitted.
   3. ASI Sign Systems Inc.; Model: InCast™ Plaque Sign System, Dimensional letters.
   4. Kroy Sign Systems: Dimensional letters.
   5. Metallic Arts: Dimensional letters.

6. Substitutions: Section 01 60 00 – Product Requirements: Product Options and Substitutions.

## 2.2 GRAPHIC PROCESS

A. Manufacture signs using 3M3D Manufacturing process for interior signs.

B. Top Film: Empire Boltaron 2310. Rigid, Clear, Embossed Poly Vinyl Chloride Calendered sheet, compounded with excellent balance or physical properties for use in membrane press process. Non-Glare, matte finish and embossed braille to meet ADA requirements.

C. Text Film: Determines Text/Copy/Pictogram Color. 3M Scotchcal Series 220 Premium Film.
1. Color: White, per SMCCCD Signage Color Standards.

D. Profile Film: 3M 1532. Provides the raised Text/Copy/Pictogram raised 1/32" to meet ADA requirements.

E. Painted Background Color: Ellis Paints; Waterborne Acrylic Enamel.
1. Color: Canada Green (PMS color 5463) per SMCCCD Signage Color Standards.

F. Laminating Adhesive: Sheet Adhesive.

G. Substrate: Acrylic Backplate. 1/8"/1/4" Acrylite or equivalent.

H. Signage Font: Frutiger Book where indicated, 3/4 inch high, minimum. Uppercase characters only on all Tactile Signs.
1. Color: 3M Scotchcal Series 220 Premium Film, White, per SMCCCD Signage Color Standards.

I. Size of letters and numbers as follows:
1. Lettering for Room identification signs: 3/4 inch.
2. Numbers for Room Number signs: 3/4 inch.
3. Pictogram Symbol size: 4 inches, International Style.
4. Overall field dimension for Pictogram Symbol: 6 inches.

J. Copy Position:
1. Room Identification Signs: Left Top – LT.
2. Toilet Room Side Mounted Signs: Centered Bottom – CB.
3. Other sign types: As shown on drawings.

## 2.3 TOILET ROOM SIGNS

A. Door-Mounted: Per CBC 1117.B.6; 1/4 inch thick with eased edges.
1. Women: 12 inch diameter circle; with International Symbol of Accessibility
2. Men: Equilateral triangle with sides 12 inches long, vertex up; with International Symbol of Accessibility.
3. Unisex Toilets: Superimposed triangle on 12 inch circle, with International Symbol of Accessibility.

B. Jamb-Mounted Signs: Per CBC 1117B.5.
1. Dimensions: 8 inch by 6 inch, with a 4 inch gender symbol, and the verbal description placed directly below followed by contracted Grade 2 California braille.
2. Corners: Square.

## 2.4 BUILDING ENTRANCE SIGNS

A. General: Per CBC 1117B.5.8.1.2; Typical 1/8 inch thick, with I.S.A. (only), size as shown on drawings.

B. Product:
   1. Dimensions: 6 inch x 6 inch minimum pictogram.
   2. Corners: Radiused.
   3. Lettering: Helvetica, Uppercase, 3/4 inch height.

## 2.5 TACTILE EXIT SIGNS

A. General: Per CBC 1011.3; Typical 1/8 inch thick.

B. Size: As shown on drawings.

C. Text and Symbols: As shown on drawings.

## 2.6 ASSISTIVE LISTENING SYSTEM SIGNS

A. General: Per CBC 1117B.5.8.4 with eased edges; Typical 1.8 inch thick.

B. Size: As shown on drawings.

## 2.7 METAL DIMENSIONAL LETTERS - CAST

A. Material: Cast aluminum in Satin Anodized finish.

B. Text: As shown on drawings.

C. Fabricated Letters:
   1. Font: Futura Medium, Upper Case, or as shown on drawings.
   2. Letter Cap Height: As shown on drawings.
   3. Letter Depth: 1 inch.

D. Surface Finish: Clear Anodized, with Acrylic polyurethane clear coat.

E. Exterior exposure rated.

F. Mounting Method: Bottom Bar Mounting, or as shown on drawings.

G. Product: ASI Sign Systems Inc., Series LC Cast Metal Dimensional Letters; Kroy Sign Systems, dimensional letters; or Metallic Arts, dimensional letters.

## 2.8 FABRICATION OF DIMENSIONAL LETTERS

A. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

E. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

## 2.9 ACCESSORIES

A. Mounting Tape: 3M VHB Foam Tape, 1/32" thick.

B. Fasteners: As recommended by manufacturer; tamper-proof torx head screws; anchors where required.

C. Adhesives: As recommended by manufacturer.

# PART 3 – EXECUTION

## 3.1 EXAMINATION

A. Verify existing conditions before starting work.

## 3.2 PREPARATION

A. Environmental Requirements: Do not install plastic signs when temperature is below 70 degrees F.

B. Examination: Examine conditions of work in place before beginning work; report defects.

## 3.3 INSTALLATION

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Locations: Install signs after doors and surfaces are finished, in locations indicated on Drawings, or as directed by Architect.

C. If sign must be affixed to glass, provide a back-up panel the same size as the sign and holder on the other side to hide adhesive.

D. Surface Mounted:
   1. Toilet Room Signs: As directed, per CBC 1117B.5.
   2. Room Name Signs: As directed, per CBC 1117B.5.
   3. Tactile Exit Signs: As directed, per CBC 1003.2.8.6.

E. Install with reviewed manufacturer's adhesive or mechanical fasteners after application of finish painting at heights noted.

F. Dimensional Letters:
   1. Install product in accordance with supplier's instructions.
   2. Install product in locations indicated using mounting methods recommended by sign manufacturer and free from distortion, warp, or defect adversely affecting appearance.
   3. Install product level, plumb, and at heights indicated.
   4. Install product at heights to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and applicable local amendments and regulations.
   5. Install signs within the following tolerances and in accordance with manufacturer's recommendations:
      a. Interior Signs: Within 1/4 inch vertically and horizontally of intended location.

## 3.4 CLEANING

A. Section 01 77 00 – Contract Closeout: Requirements for final cleaning.

B. General: Upon completion, thoroughly clean exposed surfaces per manufacturer's instructions.

C. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 10 feet.

D. Remove temporary coverings and protection to adjacent work areas.

E. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 1.

**END OF SECTION**

# SECTION 10 26 23

# PROTECTIVE WALL COVERING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes rigid vinyl sheet protective wall covering, wall guards, and corner guards.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
   3. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
   4. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
   5. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Greenguard Certification Standards:
   1. GREENGUARD Certification Standards for Low-Emitting Products.
   2. GREENGUARD Product Emission Standard for Children and Schools.

C. National Fire Protection Association (NFPA).

D. Society of Automotive Engineers (SAE):
   1. SAE J-1545.

E. Underwriters Laboratory (UL):
   1. UL 723 – Tests for Surface Burning Characteristics of Building Materials.

F. Uniform Building Code (UBC):
   1. UBC 52-4.

### 1.3 SYSTEM DESCRIPTION – PROTECTIVE WALL COVERING

A. Performance Requirements: Provide rigid vinyl sheet systems that conform to the following requirements of regulatory agencies and the quality control of IPC Door and Wall Protection Systems, InPro Corporation.
   1. Fire Performance Characteristics: Provide UL Classified Sanparrel Rigid Vinyl Sheet conforming with the NFPA Class A fire rating. Surface burning characteristics as determined by UL-723 (ASTM E-84), for Sanparrel Rigid Vinyl Sheet installed with 3M Fastbond 30, InPro Bond Adhesive, or Formulated Solutions, LLC "XT- 2000+" Adhesive shall be a maximum flame spread of 20 and a maximum smoke developed of 350 for 0.060 inch thick material.
   2. Self Extinguishing: Provide rigid vinyl sheet with a CC1 classification, as tested in accordance with the procedures specified in ASTM D635, as referenced in UBC 52-4.

3. Impact Strength: Provide Sanparrel Rigid Vinyl Sheet that has an Impact Strength of 30.4 ft-lbs/ inch of thickness as tested in accordance with the procedures specified in ASTM D256.
4. Chemical and Stain Resistance: Provide rigid vinyl sheet that show resistance to stain when tested in accordance with applicable provisions of ASTM D543.
5. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance with ASTM G21.
6. Color Consistency: Provide components matched in accordance with SAE J-1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.

## 1.4 SYSTEM DESCRIPTION – WALL GUARDS

A. Performance Requirements: Provide wall guard systems that conform to the following requirements of regulatory agencies and the quality control of IPC Door and Wall Protection Systems, InPro Corporation.
1. Fire Performance Characteristics: Provide UL Classified wall guards conforming with NFPA Class A fire rating. Surface burning characteristics, as determined by UL-723 (ASTM E84), shall be flame spread of 10 and smoke development of 350 - 450.
2. Self Extinguishing: Provide wall guards with a CC1 classification, as tested in accordance with the procedures specified in ASTM D635, as referenced in UBC 52-4-1988.
3. Impact Strength: Provide rigid vinyl profile materials that have an Impact Strength of 30.2 ft-lbs/inch of thickness as tested in accordance with the procedures specified in ASTM D256.
4. Chemical and Stain Resistance: Provide wall guards that show resistance to stain when tested in accordance with applicable provisions of ASTM D543.
5. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance with ASTM G-21.
6. Color Consistency: Provide components matched in accordance with SAE J-1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.

## 1.5 SYSTEM DESCRIPTION – CORNER GUARDS

A. Performance Requirements: Provide corner guard systems that conform to the following requirements of regulatory agencies and the quality control of IPC Door and Wall Protection Systems, InPro Corporation.
1. Fire Performance Characteristics: Provide UL Classified corner guards conforming with NFPA Class A fire rating. Surface burning characteristics, as determined by UL-723 (ASTM E-84), shall be flame spread of 10 and smoke development of 350 - 450.
2. Self Extinguishing: Provide corner guards with a CC1 classification, as tested in accordance with the procedures specified in ASTM D-635-74, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position, as referenced in UBC 52-4-1988.
3. Impact Strength: Provide rigid vinyl profile materials that have an Impact Strength of 30.2 ft-lbs/inch of thickness as tested in accordance with the procedures specified in ASTM D-256-90b, Impact Resistance of Plastics.
4. Chemical and Stain Resistance: Provide corner guards that show resistance to stain when tested in accordance with applicable provisions of ASTM D-543.
5. GREENGUARD Certified: Provide GREENGUARD Certified material. Profiles shall meet the requirements of GREENGUARD Certification Standards for Low-Emitting Products and GREENGUARD Product Emission Standard for Children & Schools.

6. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance with ASTM G-21.
7. Color Consistency: Provide components matched in accordance with SAE J-1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.

## 1.6 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Requirements for submittals.

B. Product Data: Manufacturer's printed product data for each type of Sanparrel Rigid Vinyl Sheet, each type of wall guard, and each type of corner guard specified.

C. Detail Drawings:
1. Rigid vinyl sheet: Mounting details with the appropriate adhesives for specific project substrates,
2. Wall guards: Mounting details with the appropriate fasteners for specific project substrates.
3. Corner guards: Mounting details with the appropriate adhesives for specific project substrates.

D. Samples:
1. Rigid vinyl sheet: Verification samples of Sanparrel Rigid Vinyl Sheet, 8 inch x 8 inch, of each type and color indicated.
2. Wall guards: Verification samples of wall guard, 8 inch long, in full size profiles of each type and color indicated.
3. Corner guards: Verification samples of corner guard, 8 inch long, in full size profiles of each type and color indicated.

E. Manufacturer's Installation Instruction: Printed installation instructions for Sanparrel Rigid Vinyl Sheet, wall guards, and corner guards.

## 1.7 CLOSEOUT SUBMITTALS

A. Section 01 78 39 – Project Record Documents: Operation and Maintenance Manuals.

B. Submit manufacturer's maintenance instructions for protective wallcovering, corner guards, and wall guards.

C. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

## 1.8 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain protective wallcovering system components from a single source.

## 1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite

B. Inspect materials at delivery to assure that specified products have been received.

C. Store in original packaging in a climate controlled location away from direct sunlight.

## 1.10 PROJECT CONDITIONS

A. Environmental Requirements: Products must be installed in an interior climate controlled environment.

## 1.11 WARRANTY

A. Section 01 77 00 - Contract Closeout: Requirements for warranties.

B. Furnish standard IPC Limited Lifetime Warranty against material and manufacturing defects.

## 1.12 EXTRA MATERIALS

A. Furnish one 3 feet x 8 feet sheet; or minimum 2 percent of each type, color and pattern of wall surface protection materials and components. Include accessory components as required. Replacement materials shall be from the same production run as installed materials. Package with protective coverings and appropriate labels.

# PART 2 - PRODUCTS

## 2.1 PROTECTIVE WALL COVERING AND WALL GUARDS

A. Manufacturers:
1. IPC Door and Wall Protection Systems, InPro Corporation, www.inprocorp.com.
2. Koroseal Wall Protection Systems; www.korogard.com
3. Substitutions: Section 01 60 00 – Product Requirements: Product options and substitutions.

B. Product Description and Basis of Design for Wall Covering: InPro Corporation, Sanparrel Rigid Vinyl Sheet protective wall covering.

C. Product Description and Basis of Design for Wall Guards: InPro Corporation, 500 Wall Guard.
1. 500 Wall Guard Profile: 3 inch height x 1 inch depth.

D. Product Description and Basis of Design for Corner Guards: InPro Corporation, 160F Flush Mount Corner Guard.
1. 160F Flush Mount Corner Guard Profile:
   a. 2" x 2" legs, 90 degree corner.
   b. 4', 8', 9', and 12' standard heights.
   c. Custom heights and angles available.

## 2.2 COMPONENTS

A. Rigid Vinyl Sheet:
1. Sanparrel, Rigid Vinyl Sheet Options:

| Item # | Dimensions | Thickness |
|---|---|---|
| 305 | 3 feet x 8 feet | 0.040 inch (1mm). |
| Also available: | | |
| a. | 3 feet x 10 feet sheets | 0.040 inch (1mm). |
| b. | 3 feet x 120 feet rolls | 0.040 inch (1mm). |

2. Backing: Unbacked.
3. Accessories:
   a. Top Cap: #407.

1) Length: 8 feet, standard, 10 feet, available.
b. Inside Corner: #409.
1) Length: 8 feet standard, 10 feet available.
c. Outside Corner: 3448, 3496, 11248 or 11296. .
e. Color Matched Caulk: 580 Color matched VinylSeal.

B. Wall Guard Components:
1. 502 Series End caps, outside corners and brackets: Injection molded thermoplastics.
2. Fasteners: Provide all mounting system accessories appropriate for substrates indicated on the drawings.

C. Corner Guard Components:
1. Cove Base Retainer: Optional cove base retainer shall be fabricated from 6063-T5 aluminum with a mill finish.
2. Closure Cap: Optional closure cap shall be fabricated from 0.032-inch thick aluminum.
3. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.

## 2.3 MATERIALS

A. Vinyl: Sanparrel shall be manufactured from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

B. Vinyl for Wall Guards: Snap on cover of 0.080 inch thickness, extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

C. Vinyl for Corner Guards: Snap on cover of 0.080-inch thickness shall be extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

D. Aluminum for Wall Guards: Continuous aluminum retainer of 0.080 inch thickness, fabricated from 6063-T5 aluminum, with a mill finish.

E. Aluminum for Corner Guards: Continuous aluminum retainer of 0.070-inch thickness, fabricated from 6063-T5 aluminum, with a mill finish.

## 2.4 ACCESSORIES

A. Top caps, inside corners, and outside corners: Extruded PVC.

## 2.5 FINISHES – PROTECTIVE WALL COVERING

A. Color: Clam Shell.
1. Surface Texture: Haircell texture.

B. Accessories: Top caps, inside corners, divider bars and outside corners shall be of a color matching the Sanparrel.

## 2.6 FINISHES – WALL GUARDS

A. Vinyl Covers Color: Clam Shell.
1. Surface Texture: Pebblette texture.

B. Molded Components: End caps, outside corners and brackets shall be of a color matching the wall guards.
   1. Surface: Pebblette texture.

## 2.7 FINISHES – CORNER GUARDS

A. Vinyl Cover: Color of corner guard to be selected by Architect from the IPC finish selection. Surface shall have a pebblette texture.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas and conditions in which the rigid vinyl sheet, wall guards, and corner guards systems will be installed.
   1. Complete all finishing operations, including painting, before beginning installation of rigid vinyl sheet materials, wall guards, and corner guard system materials.

B. Wall surface shall be dry and free from dirt, grease and loose paint.

## 3.2 PREPARATION

A. General: Prior to installation, clean substrate to remove dust, debris and loose particles.

## 3.3 INSTALLATION – RIGID VINYL SHEET

A. General: Locate the rigid vinyl sheet as indicated on the approved detail drawing for the appropriate substrate and in compliance with the IPC installation instructions. Install level and plumb at the height indicated on the drawings.

B. Installation of Sanparrel Rigid Vinyl Sheet with manufacturer's recommended adhesive:
   1. Adhere to substrate with InPro Bond, a freeze-thaw stable, nonflammable, high strength, water based adhesive that trowels on and allows approximately 20 minutes working time before firming.
   2. Adhere to substrate with XT-2000+, a freeze-thaw stable, nonflammable, high strength, water based adhesive that trowels on and allows approximately 20 minutes working time before firming.
   3. Adhere to substrate with Fastbond 30, a nonflammable, high strength, water-dispersed contact adhesive, with very little odor.
   4. Smooth roll surface.

C. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.

D. Install aluminum retainers, mounting brackets, and other accessories in strict accordance with the manufacturer's instructions.

E. Where splices occur in horizontal runs of over 20 feet, splice aluminum retainer and plastic cover at same locations along the run.

F. Install corner guards to walls securely in accordance with manufacturer's written instructions.

G. Install corner guards accurately in location, alignment, and elevation.

H. Install protective wallcovering to walls in accordance with manufacturer's written instructions.

I. Install protective wallcovering sheets with texture running in the same direction for uniform appearance.

J. Wainscot Joints: Butt joint panels, leaving a 1/16 inch gap between vinyl panels to allow for expansion. Seal joint with color matched VinylSeal.

## 3.4 INSTALLATION – WALL GUARDS

A. General: Locate the wall guard as indicated on the approved detail drawing for the appropriate substrate and in compliance with the IPC installation instructions. Install wall guard level and plumb at the height indicated on the drawings.

B. Installation of 500 Wall Guard:
1. Cut the aluminum retainer to the desired length, allowing 1-9/16 inch for each end cap, and 9/16 inch for each outside corner.
2. Using a 1/4-inch drill bit, drill holes in the centerline of the aluminum retainer 4 inches from each end and spaced evenly over the entire length (6 anchors per 12 feet length.
3. Position and level the aluminum retainer on the wall, allowing for end caps and outside corners, and transfer mounting holes to the wall with a marker. Drill 1/4-inch holes at each mark and position the ALLIGATOR anchors into the holes on the wall. Mount the retainer with #10 x 1-3/4" Phillips pan head screws and tighten the screws to secure the retainer.
4. Slide the end caps and outside corners onto the aluminum, leaving a 1/16-inch gap for adjustments, and secure them by using one 1-1/4 inch self-tapping screw per end cap or two per outside corner.
5. Cut the vinyl cover to the distance between the end caps/outside corners. NOTE: Trim all factory edges square before installation. Position the vinyl cover on the aluminum retainer starting at one end and working to the other end by pushing the cover over the aluminum until it snaps into place.

## 3.5 INSTALLATION – CORNER GUARDS

A. General: Locate corner guard as indicated on approved detail drawings for the appropriate substrate, and in compliance with the IPC installation instructions. Install corner guard level and plumb.

B. Installation of 160F Flush Mount Corner Guard:
1. Drywall installation: Drywall must be installed 1-1/2 inch back from the corner of the stud.
2. Position the aluminum retainer in the recess formed by the drywall. The mounting flange of the retainer rests over the edge of the drywall. If you are using the aluminum cove base retainer, snap it on the aluminum retainer before attaching the retainer to the studs.
3. Attach the aluminum retainer to the studs using 1-1/4" bugle head drywall screws, 18" on center, through the pre-punched holes on the mounting flange
4. Cover the mounting flange with joint compound. Feather and finish with the surface of the drywall. When installing flush mount corner guards at less than ceiling height, use the optional closure cap. Attach the closure cap to the top of the aluminum retainer with 1-1/4" Phillips round head self tapping screws through each mounting tab. Feather and finish the exposed edge of the closure cap with the surface of the drywall. Alternately, standard drywall trim may be used to finish the top edge. Appropriate use of trim will aid in the feathering of joint compound to the corner guard vinyl.

5. After the joint has been finished, position the vinyl cover over the aluminum retainer. Push the vinyl cover over the aluminum, pressing over the entire length until the vinyl snaps securely in place.

## 3.6 CLEANING

A. Section 01 74 00 – Cleaning: Requirements for final cleaning.

B. At completion of the installation, clean surfaces in accordance with the IPC clean-up and maintenance instructions.

**END OF SECTION**

# SECTION 11 61 00

# STAGE EQUIPMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This section includes commercial electronic remote lowering system for stage lighting track.

B. Related Sections:
1. Division 26 – Electrical: Electrical power to remote lowering system.
2. Section 26 50 00 – Lighting: Stage lighting track.

C. Alternates: Refer to Section 01 23 00 – Alternates, for work of this section affected by Alternates.

### 1.2 SYSTEM DESCRIPTION

A. An electronically controlled, motorized lowering system designed to raise and lower stage lighting track weighing from 20 pounds to 250 pounds. The systems comes with either the motor platform remote from the disconnect unit, or with the disconnect unit mounted on the motor platform. For this installation, the motor platform will be remote from the disconnect units.

B. Self-Sustaining Gear Drive Unit: A self-sustaining worm gear drive arrangement prevents free falling of the stage lighting track while lowering, raising or servicing.

C. Contact Suspension Unit: Automatically guides stage lighting track up and down through the maze tracking system. Supports stage lighting track and always returns to same position. Locking electrical disconnect switch provides power to the stage lighting track and mechanically locks the track in place, relieving all tension on cable, gears and motor.

D. Electronic Control Module: Microchip technology provides capability to unlock stage lighting track from contact unit and lower it to predetermined height with the push of a single button. Programmed sequencing allows operator to view raising and lowering of stage lighting track without having to continually push or twist a switch.

E. Each motor can raise and lower only one cable. Each Lighting Track will require two cables for support; therefore, provide a total of 4 motors and 4 electrical disconnect units for this installation.

### 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate mounting details, wiring diagrams, cabling routing, pulley types and locations, and interface with stage track lighting.

C. Product Data: Submit manufacturer's product data.

D. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions.

### 1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Contract Closeout: Requirements for submittals.

B. Submit Operation and Maintenance Data.

## 1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

# PART 2 - PRODUCTS

## 2.1 REMOTE LOWERING SYSTEM

A. Manufacturers:
   1. Lighting and Lowering Systems®; www.lightinglowering.com
   2. Substitutions: Section 01 63 00 – Product Options and Substitutions.

B. Product Description and Basis of Design: Model CELS-300-REM Commercial Electronic Remote Lowering System.

## 2.2 COMPONENTS

A. Electrical Disconnect Unit (EDU) Assembly: Product comes with two electrical contacts plus one ground as standard. (Additional contacts available) and includes fittings for surface mounting to a structure and a flange/stem adapter (3/4" male or 3/8" female available).
   1. The EDU shall have a 3-way tracking guide and support.
   2. Construction: Precision cast high strength aluminum alloy 356-T6.
   3. A permanently fixed position piece incorporating a special tracking guide system permits the moveable portion of the Disconnect Unit to align in the same position every time the system is operated, thereby eliminating the need to re-orientate the fixture.
   4. The EDU shall have twin high strength stainless steel locking cams securing the load of the Lower Contact Assembly and fixture.
   5. All tension on the cable is relieved when the fixture is in the raised position.
   6. The Multi-Contact Connector Assembly shall be modular for easy installation and retrofit requirements. All pin and socket contacts shall be insertable and removable. The connector shall also have four size 12 contacts. Materials of contacts shall be copper with nickel plating, and with gold plating over nickel per MIL-G-045204. Electrical contacts shall have a rating of 20 year mean time between failures. All hardware shall be corrosion-resistant stainless steel. It shall have a self-aligning and self-adjusting mechanical system comprised of two principal assemblies:
      a. The Upper Contact Half shall house the socket contacts. It shall incorporate spring assisted polymer contact body with precision-machined stainless steel guideposts. The socket contact body shall have integral guideposts for precise contact alignment.
      b. The Lower Contact Half shall house the pin contacts comprised of spring-assisted polymer contact body with precision-machined stainless steel guideposts receivers. The pin contact body aligns with guideposts of integral socket body guideposts.

7. The wire leads are potted in Superflex® Black RTV Silicone, and industrial grade sealant for bonding and sealing.
8. The unit shall have a guidepost constructed of precision cast high strength stainless steel. It shall utilize a casts-in-place guide bar for precise alignment of Lower Contact Assembly with the fixed portion of the EDU.
9. The EDU shall have twin tracking support arms made of prec8iion cast high strength stainless steel. When locked in the 3-Way Tracking Guide and Support notches, the Twin Tracking/Support Arms shall hold the weight of the fixture and components and it shall remove all tension from the Control Cable or Lowering Cable.
10. The lower contact assembly shall be constructed of precision cast high strength aluminum alloy. It shall feature a cast-in-place guide that mate with the fixed portion of the Disconnect Unit to aid in tracking and stability. All hardware used on the Lower Contact Assembly as well as the entire Disconnect U nit shall be made of corrosion resistant stainless steel.
11. The disconnect unit shall have Housing Seal made up of a spun aluminum closure ring with a sealing gasket constructed of extra flexible polymer providing a weather-tight seal between Lower Contact Assembly and Disconnect Unit Cover. This provides a flexible environmental seal. Seal swipes and conforms to interior of cylinder housing during all operating stages of the disconnect unit.
12. Electrical Contact Rating:
    a. 120V, 20 Amps per contact (Multiple circuits).
    b. 240V/277V, 15 Amps per contact (Multiple circuits)
13. Mechanical Rating: 400 lbs with 6:1 safety factor.
14. Weight: 8.5 lbs.

B. Motor Platform Assembly: Consists of formed and painted steel platform, 1/4 HP motor, cable spool/gear box, one change of direction pulley, electrical connection box, and a formed and painted steel cover.
   1. Dimensions: 26-1/4" L x 16" W x 8-3/4" H.

C. Cable: 1/8" diameter, 7x19 stranded, galvanized steel aircraft cable assembly. Total cable length required = lowering distance + 5 ft + horizontal run + vertical run. 40 ft. maximum lowering distance.

D. Control Panel: An electronic programmable control module. It includes the cover plate and connection box. Electrical hook up wires and conduit to are be provided by Division 26.

E. Motor: 1/4 HP permanent split capacitor with thermal overload protection. Draws maximum 2.6 amps including control system at 115 VAC 60 HZ. Must be mounted in an accessible location.
   1. Gearing: Self-sustaining worm gear drive.
   2. Load Capacity: Minimum 20 pounds, maximum 250 pounds.

F. Gearing: Self-sustaining worm gear drive.

G. Mounting: The motor platform fits 16" or 24" centers. The assembly is pre-wired ready to install for standard construction. The disconnect unit can be mounted on platform or mounted on a different structure in non-remote systems.

H. Load Capacity: Minimum 20 pounds, maximum 250 lbs.

I. Cable: 1/8" diameter 7x19 galvanized steel. 40 feet provided for 35 feet lowering distance. For additional cable, contact factory.

J. Maximum Lowering Distance: 40 feet. Must have 5 extra feet of cable on the drum. Additional cable needed for horizontal distance from winch to Disconnect Unit.

K. Voltage: 95 - 135 VAC 60 HZ at 1/4 ampere plus motor current. Only 2.6 motor amps. Lighting fixture requirements must be on separate circuit. Consult electrical contractor.

L. Disconnect Unit Electrical Requirements: Model SCU-2A-MS-4C Disconnect Unit; maximum 15 amps, 277 Volt; or 20 amps, 120 volt per circuit.

M. Fixture load maximum is 2400 watts. For larger loads consult factory. Standard unit has four electrical contacts for two circuits. Contact factory for multiple circuit units.

N. System Speed: 1-1/2 feet per minute average.

O. Chain-links: Optional.

## 2.3 ACCESSORIES

A. Various types of pulleys are available and should be designed for exact load and gear box. All pulleys have oilite bronze bearings for maintenance free life. This also insures their use for dirty atmosphere applications. Painted pulleys are available for highly corrosive areas. Pulleys can be spaced 6' - 30' apart on horizontal runs. A pulley must be used at every 30' of horizontal straight runs. Pulleys are required when vertical or horizontal changes in direction occur. It is important that pulleys are properly aligned. The centerline of the pulley-sheave grove must coincide with the centerline of the cable path when installing. Always take pulley friction into consideration if loads are near limits of the gear box. Pulleys must be installed on rigid surfaces which are able to withstand at least 5 X load of the fixture in all directions. The installation must be approved by others.

B. 3P-6 Pulley:
1. Load capacity for a 3P-6 pulley is 20-400 lbs. A 3P-6 pulley can facilitate a change in direction of the cable from wall to ceiling i.e. from vertical to horizontal. 3P-6 pulleys should be spaced 6-30' apart on horizontal runs. Change in direction of cable to angles other than 90 degrees is possible. This pulley allows the twisted quick-link to pass through.

C. 3P-7 Pulley:
1. A 3P-7 pulley can facilitate a change in direction of the cable on the same plane (i.e. on the ceiling or on the wall. The pulley allows the cable connecting link to pass through.
   a. Load Capacity: Up to 400 lb. fixtures.
   b. Frame Material: Frame material of zinc-placed 7 gauge steel.
   c. Frame Material Option: Stainless steel frame. Contact factory.
   d. Sheave Material: Sheave of cast aluminum with oilite bronze bearing.
   e. Mounting: Two mounting holes for 3/8" diameter bolts. Hardware by others. Type of hardware depends on the type of structure that pulley is mounted to. Structure must not move while the system is in operation.

D. 3P-5 Pulley:
1. Load capacity for a 3P-5 pulley is 20-400 lbs. A 3P-5 pulley can facilitate a change in direction of the cable in different planes due to the swivel nature.

E. 3P-6 and 4P-4 Uses:
1. 3P-6 and 4P-4 pulleys (depending on load) can facilitate a change in direction of the cable from wall to ceiling; i.e. from vertical to horizontal. These pulleys should be spaced 6' to 30' apart on horizontal runs. Change in direction of cable to angles other than 90 degrees is possible. These pulley can be placed horizontally, vertically, and on inclined surfaces for maximum versatility as long as the cable path is aligned to the pulley sheave grove and as long as the cable path is not interfered by an obstacles.

F. 3P-7 and 4P-3 Uses:
1. 3P-7 and 4P-3 pulleys (depending on load) can facilitate a change in direction of the cable on the same plane.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
1. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

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

B. Mount the disconnect units to a horizontal rigid structure. All mounting must be able to withstand static and dynamic loading for at least 5X weight of the stage lighting track in all directions.

C. Place the motor assemblies 6' to 30' away from the first pulley or disconnect. A pulley must be used every 6' to 30' of horizontal straight run. Centerline of pulley groove must be aligned with cable path. Cable path must be free from interference.

D. Cable Orientation Options: The disconnect units allow the cable path orientation at an angle. The pulley installed in the upper casting attached to the disconnect guides the cable in the required orientation.

**END OF SECTION**

# SECTION 12 48 13

# ENTRANCE FLOOR MATS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This section includes the following types of entrance flooring systems:
   1. Floor Mats and Frame Assemblies.

### 1.2 REFERENCES

A. ASTM International.
   1. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
   2. ASTM D2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
   3. ASTM E648 – Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant heat Energy Source.

B. The Aluminum Association.

C. The Carpet and Rug Institute (CRI).

D. The National Floor Safety Institute (NFSI).

### 1.3 SUBMITTALS

A. Section 01 32 19 – Submittal Procedures: Requirements for submittals.

B. Product data for each type of floor mat and frame specified including manufacturer's specifications and installation instructions.

C. Shop drawings in sufficient detail showing layout of mat and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.

D. Samples for verification purposes: Submit an assembled section of floor mat and frame members with selected tread insert showing each type of color for exposed floor mat, frame and accessories required.

E. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats.

### 1.4 QUALITY ASSURANCE

A. Flammability in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/$m^2$.

B. Slip resistance in accordance with ASTM D2047, Coefficient of Friction, minimum 0.60 for accessible routes.

C. Standard rolling load performance is 1000 lb./wheel (load applied to a solid 5" x 2" wide polyurethane wheel, 1000 passes without damage).

D. Single Source Responsibility: Obtain floor mats and frames from one source of a single

manufacturer.

E. Utilize superior structural aluminum alloy 6063-T6 for rail connectors.

## 1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

## 1.6 PROJECT CONDITIONS

A. Field measurements: Check actual openings for mats by accurate field measurements before fabrication. Record actual measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

B. Defer frame installation until building enclosure is complete and related interior finish work is in progress.

# PART 2 - PRODUCTS

## 2.1 ENTRANCE FLOOR MATS

A. Manufacturers:
1. Construction Specialties, Inc.; www.c-sgroup.com
2. Kadee Industries; www.KadeeIndustries.com
3. Substitutions: Section 01 60 00 – Product Requirements: Product options and substitutions.

B. Product Description and Basis of Design: C-S Group; G4 PediTred. Drawings and specifications are based on manufacturer's literature from Construction Specialties, Inc. unless otherwise indicated. Other manufacturers must comply with the minimum levels of material and detailing indicated on the drawings and specified herein.

## 2.2 MATERIALS

A. Aluminum: ASTM B221, alloys 6063-T5, 6063-T6 for extrusions.

B. Flexible and prime PVC extrusions.

C. Tread insert: Refer to Article 2.5.

## 2.3 FLOOR MATS

A. Model and Description: G4 PediTred shall be extruded 6105-T5 aluminum alloy with 3/4" deep tread rails joined by an EPDM hinge and cushion to compromise the overall grid length (traffic direction). The hinge shall be complete with perforations between each tread rail for drainage, unless otherwise specified. Rail finish: Clear anodized. Unit must withstand 1000 lb. wheel loads (load applied to a 5" x 2" wide polyurethane wheel, 1000 passes without damage).

## 2.4 MAT FRAMES

A. TA – Surface Mounted Aluminum Frame: 3-1/2 inch wide 6063-T6 aluminum alloy and permanently positions mat for surface-mounted applications. Frame color: Clear anodized.

## 2.5 TREAD INSERT

A. HD MonoTuft HD™ Carpet shall meet the Carpet and Rug Institute's standard for indoor air quality. Fibers shall include a minimum of 100, 12 mil monofilament fibers per square inch and colorfast, solution-dyed nylon.
   1. Color: 7325 Wrought Iron.
   2. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths.
   3. Anti-static carpet fiber shall contain antimicrobial additive and be treated with Scotchgard® to reduce soiling.
   4. Carpet weight: 33-oz./yd².

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Do not proceed until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped mat assemblies to ensure a proper installation.

## 3.3 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations.
   1. Securely fasten floor mats at exposed edges.

B. Set mat at height recommended by manufacturer for most effective cleaning action.

C. Coordinate top of mat surface with bottom of doors that swing across to provide ample clearance between door and mat.

## 3.4 CLEANING

A. Section 01 74 00 – Cleaning: Requirements for cleaning.

B. It is important to the life cycle of the entrance mat that a maintenance schedule be developed which includes regular vacuuming and extraction that correctly matches the amount of traffic the mat incurs.

## 3.5 PROTECTION

A. Defer installation of floor mats until time of substantial completion of project.

**END OF SECTION**

# SECTION 21 00 00

# BASIC FIRE SUPPRESSION REQUIREMENTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work Included: Work included in 21 00 00 applies to Division 21 work to provide materials, labor, tools, permits and incidentals to provide and make ready for Owner's use complete, operable and approved fire suppression systems for proposed project.

B. Refer to Architectural, Structural, Mechanical, Plumbing, Electrical, and Civil Drawings for additional information relating to the fire suppression system.

C. Related Work Specified Elsewhere:
1. Contents of Section applies to Division 21 specifications.
2. Requirements of Section are a minimum for Division 21 Sections, unless otherwise stated in each Section, in which case that Section's requirements take precedence.

D. Products furnished and installed under Division 21, with electrical connections not provided under Division 21:
1. Tamper switches.
2. Waterflow detector.
3. Alarm bells, exterior.
4. High/low pressure alarm switch.
5. Pressure switch.
6. Jockey pumps.
7. Pump controllers.

### 1.2 DEFINITIONS

A. Following is a list of abbreviations generally used in Division 21:

| | | |
|---|---|---|
| 1. | AHJ | Authority Having Jurisdiction |
| 2. | ANSI | American National Standards Institute |
| 3. | ASME | American Society of Mechanical Engineers |
| 4. | ASTM | American Society for Testing and Materials |
| 5. | ASSE | American Society of Sanitary Engineering |
| 6. | AWWA | American Water Works Association |
| 7. | CBC | California Building Code |
| 8. | CEC | California Electrical Code |
| 9. | CMC | California Mechanical Code |
| 10. | CPC | California Plumbing Code |
| 11. | ETL | Electric Testing Laboratories |
| 12. | FM | FM Global |
| 13. | HVAC | Heating, Ventilating and Air Conditioning |
| 14. | MSS | Manufacturers Standardization Society |
| 15. | NEC | National Electric Code |
| 16. | NEMA | National Electrical Manufacturers Association |
| 17. | NFPA | National Fire Protection Association |
| 18. | OSHA | Occupational Safety and Health Administration |
| 19. | UL | Underwriters Laboratories Inc. |
| 20. | UPC | Uniform Plumbing Code |

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

C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly and installation.

D. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at the project site as required to complete items of work furnished by others.

## 1.3 ADDITIONAL DEFINITIONS TO DIVISION 01

A. Code: Indicates the Regulatory Requirements as applicable to that reference.

B. AHJ: Indicates reviewing authorities, including the local fire marshal, the Owner's insurance underwriter, Owner's representative, and any other reviewing entity whose approval is required to obtain systems acceptance.

## 1.4 ADDITIONAL REQUIREMENTS TO DIVISION 01

A. Submit the following for review. Include in operations and maintenance manual.

B. Shop Drawings, Calculations, Component Manufacturer's Data Sheets: Submit as one complete standalone package to AHJ, Owner's insurance underwriter, and Engineer. Drawings shall show information required by NFPA 13 and 14, including room names and occupancy classifications. Refer to individual Specification Sections for additional requirements for the shop drawings, calculations and specific items required in product data submittal.
   1. Shop Drawings: Provide shop drawings which include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and the like.
   2. Calculations: Hydraulic, sway brace, air compressor, antifreeze expansion tank, fire suppression water tank, fire pump, and the like calculations.
   3. Product Data: Submit manufacturer's technical data, installation instructions and dimensioned drawings for products, sprinklers, equipment and devices installed, supplied or provided. Submit at one time in 3-ring binder, tabbed and referenced to match the Contract Documents.
   4. Maintain an updated product submittal package to be included in the final operation and maintenance documentation.

C. Operation and Maintenance Documentation: Copies of certificates of code authority acceptance, code-required acceptance tests; test reports, parts lists, maintenance information for equipment, valves, and other special guarantees, certificates of warranties, and the like, specified elsewhere herein or indicated on Drawings. Record Drawings, water supply flow test, calculations, manufacturer's data sheets and operation and maintenance instructions, servicing requirements, test reports and certificates, Contractor's Material and Test Certificates for Aboveground Piping/Underground Piping and NFPA 25.

D. Close-out Documentation: Submit fire suppression code authority certification of inspection.

E. Record Drawings:
   1. Show changes and deviations from the Drawings. Include issued Addendum and change order items.
   2. Make changes to the Drawings in a neat, clean, and legible manner.

F. Guaranty: Guaranty systems against defective equipment, materials and workmanship for a period of 1 year after Owner's acceptance.

## 1.5 QUALITY ASSURANCE

A. Where Contract Documents are at variance with applicable codes governing work, code and local jurisdiction requirements take precedence, and include cost necessary for code compliance or local jurisdiction compliance in bid price. Machinery and equipment to comply with Occupational Safety and Health Act of 1970, as currently revised, as interpreted for equipment manufacturer requirements.

B. Qualifications: Company specializing in fire-suppression sprinkler, fire-suppression standpipe and hose, fire pump, systems of similar type and scope with 3 years experience.

C. In addition to state regulatory requirements for licensing of contractor and design of fire suppression systems, construction drawings, hydraulic, sway brace, fire pump, and the like calculations to be sealed and signed by a professional engineer licensed in the state of California. This is required to comply with San Mateo County Community College District Design Standards.

D. Mechanical Drawings: Drawings are intended to be diagrammatic and are based on one manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., equipment and piping) and equipment proposed to assure that systems and equipment will fit in available space and conform to code location. Contractor is responsible for design and construction costs incurred for equipment other than basis of design, including but not limited to architectural, structural, electrical, fire sprinkler, standpipe, fire pump, and fire extinguishing systems.

E. Requirements: As a minimum requirement, work in accordance with following rules and regulations and applicable laws: Apply edition as enforced by AHJ unless otherwise stated. Comply with state and local amendments.
1. OSHA.
2. Related supplements and standards.
3. State of California and local jurisdictional requirements.
4. ASCE 7, Minimum Design Loads for Buildings and Other Structures, as adopted by AHJ.
5. CBC, as adopted by AHJ, California Building Standards Code.
6. CFC, as adopted by AHJ, *California Fire Code.*
7. CMC, as adopted by AHJ, California Mechanical Code.
8. CPC, as adopted by AHJ, California Plumbing Code.
9. San Mateo County Community College District Design Standards: Basic Fire Protection System Design.
10. UL Fire Protection Equipment Directory.
11. UL Online Certifications Directory.
12. FM Global Approval Guide.
13. NFPA 13, as adopted by AHJ, Standard for the Installation of Sprinkler Systems.
14. NFPA 14, as adopted by AHJ, *Standpipe and Hose Systems.*
15. NFPA 20, Latest Edition, Installation of Stationary Pumps.
16. NFPA 24, Latest Edition, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
17. NFPA 25, Latest Edition, Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
18. NFPA 291, Latest Edition, Recommended Practice for Fire Flow Testing and Marking of Hydrants.

F. Permits and Inspections:
1. Unless otherwise distinctly hereinafter specified, apply and pay for necessary permits, plans check, and inspections required by public AHJ.
2. Refer to General and Supplementary Conditions for payment of water service connection fees.

3. Obtain certificates of inspection from AHJs and deliver to Owner before final acceptance.
4. Each trade to consult local building department, fire department and utility companies prior to commencement of work to ascertain existence and location of existing underground utilities. Protect existing service against damage and interruption of use, and reroute as may be necessary to accomplish new work. Include costs for materials and installation for rerouting as specified for new work in bid price.

G. Material and Equipment: Listed for its intended fire suppression use in current UL Fire Protection Equipment Directory, or UL Online Certifications Directory for Fire Protection, or FM Global Approval Guide.

## 1.6 SEQUENCING AND SCHEDULING

A. For proper execution of work cooperate with other trades as needed.

B. To avoid installation conflicts, thoroughly examine complete set of Contract Documents. Resolve conflicts with Architect prior to fabrication and installation.

C. Prior to installation of equipment requiring electrical connections, examine manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that electrical characteristics indicated in Contract Documents are consistent with electrical characteristics of actual equipment being installed. When inconsistencies occur request clarification from Architect.

## 1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of piping, fire sprinklers, standpipes, fire pumps, controllers and electrical services with architectural and structural requirements, and other trades (including plumbing, HVAC equipment, ductwork, grilles, diffusers, electrical, lights, ceiling suspension, and tile systems), and provide reasonable maintenance access requirements.

B. Where pipes pass through walls/floors/ceilings and structural members, verify the openings with structural engineer.

## 1.8 EXISTING SOILS CONDITIONS

A. Understand existing soils conditions before submitting bid on work. No additional allowance will be granted due to lack of information for existing conditions of subsurface soils.

B. Submission of a bid will be considered acknowledgment of review/understanding of project geotechnical soils report.

# PART 2 - PRODUCTS

## 2.1 HAZARDOUS MATERIALS

A. Do not use products containing asbestos, lead, arsenic, or any other material defined by EPA as hazardous to human or animal life.

## 2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and sprinklers used for construction are to be new, the latest products as listed in

manufacturer's printed catalog data and are to be UL or CSA approved or acceptable by state, county, and city authorities. Equipment supplier is responsible for obtaining state, county, and city acceptance on equipment not UL approved or not listed for installation.

B. Materials, sprinklers, and equipment of a kind to be standard product of one manufacturer and of current manufacture.

C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

## PART 3 - EXECUTION

### 3.1 ACCESSIBILITY AND INSTALLATION

A. Install equipment having components requiring access (i.e., drains, valves, motors, engines, controllers, air compressors, gauges, fill cups, tanks, drives, and the like) so that they may be serviced, reset, replaced or recalibrated and the like, by service people with normal service tools and equipment. Notify Architect in writing if equipment or components are shown in such a position that above cannot be accomplished.

B. Install equipment complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment, examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods and sequencing, in coordination with other trades and disciplines.

C. Earthwork:
1. Refer to Division 31.
2. Perform excavation and backfill for installation of fire suppression work.

D. Firestopping:
1. Coordinate with Drawings location of fire rated walls, ceilings, floors and the like. When these assemblies are penetrated, seal around piping, ductwork, equipment, and the like, with approved firestopping material.
2. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

### 3.2 NOISE AND VIBRATION

A. Install vibration isolators and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.

B. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Architect.

### 3.3 SEISMIC CONTROL

A. Provide the following:
1. General:
   a. Earthquake resistant designs for mechanical equipment, i.e., standpipes, pumps, tanks, fire suppression piping, to conform to regulations of CBC.
   b. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not

be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment, piping, and the like, to withstand a force in direction equal to value defined in CBC.

c. Retain licensed structural engineer to provide shop drawings of seismic bracing and seismic movement assemblies for piping/tanks/pumps, and the like. Engineer to design and provide stamped shop drawings for equipment, tanks, pumps, piping seismic bracing, and the like. Submit shop drawings along with equipment submittals.

d. Retain licensed structural engineer to provide shop drawings of seismic flexible joints for piping and the like crossing building expansion or seismic joints. Engineer to design and provide stamped shop drawings for piping flexible seismic joints. Coordinate actual design deflection or travel with project structural engineer. Submit shop drawings along with seismic bracing details. Coordinate exact design requirements from project structural engineer.

2. Piping:
   a. Use sway brace requirements of CBC and NFPA 13.
   b. As approved by code authority, use a bracing system manufactured by Tolco, Afcon, or approved.
3. Equipment:
   a. Provide sway bracing to prohibit excessive motion of fire suppression equipment and piping during earthquake.
   b. Provide fire suppression equipment and piping, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to 0.5 of equipment operating weight or lateral seismic forces as determined by building code calculations, whichever is more demanding.

## 3.4 REVIEW BY ENGINEER

A. Notify Architect/Engineer, in writing, at following stages of construction so that Architect/Engineer may, at their option, visit site for review and construction observation:
   1. Fire Suppression:
      a. Underground piping installation prior to backfilling.
      b. When ceiling installation is started.
      c. When mains or branchlines are to be permanently concealed by construction or insulation systems.
      d. When fire suppression systems, or portions of, are being tested and ready for inspection by AHJ.

## 3.5 OPERATING DURING CHANGEOVER

A. During remodeling of existing structure, or addition of a structure to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.

B. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, wiring, and the like, to point of connection.

C. Perform actual transfer to new service at off-peak time, as coordinated with Owner. Once changeover is started, pursue it to its completion, to keep interference to a minimum.

D. During changeover, for the entire time system, or part thereof, is not operational, provide a fire watch, including a watchperson whose sole duty is to watch for and report fires.

## 3.6 MUTILATION

A. Repair mutilation of building around pipes, equipment, hangers, braces, and the like.

## 3.7 DEMOLITION

A. Scope:
   1. It is intent of these documents to provide necessary information and adjustments to fire suppression system required to meet code, and accommodate installation of new work.
   2. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access, access to different areas.
   3. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.

B. Equipment: Unless otherwise directed, equipment, piping or fittings being removed as part of the demolition process are the Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.

C. Unless specifically indicated on the Drawings, the Contractor shall remove all unused piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap piping and patch surfaces to match surrounding finish.

D. Unless specifically indicated on the Drawings, the Contractor shall remove all unused equipment, fixtures, rough-ins, connectors, etc. Removal is to be to a point behind finished surfaces (floors, walls, ceilings, etc.).

## 3.8 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize mechanical equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

## 3.9 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

B. Maintain design intent where equipment other than as shown in Contract Documents is provided. Where equipment requires piping arrangement, control diagrams, or sequencing different from that indicated in Contract Documents, provide electrical motors, wiring, controls, or other required electrical components at no additional cost to Owner.

## 3.10 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and equipment in a manner to prevent damage and deterioration. Store in original container which identifies manufacturer's name, brand and model number. Do not store indoor equipment outdoors unless provided with a waterproof protective cover.

B. Replacement: In event of damage, immediately make necessary repairs and replacements.

## 3.11 DEMONSTRATION

A. Upon completion of work and adjustment of equipment, test systems to demonstrate to

Owner's Representative and Architect that equipment furnished and installed or connected under provisions of these Specifications functions mechanically in manner required.

B. Manufacturer's Field Services: Furnish services of a qualified person for a period of not less than 4 hours, at a time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in a satisfactory manner and complies with requirements of other trades or Contractors that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

## 3.12 CLEANING

A. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated by this work.

## 3.13 INSTALLATION

A. Install equipment and piping in accordance with manufacturer's installation instructions, plumb and level except where required to be pitched. Maintain manufacturer's recommended clearances.

B. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

## 3.14 CUTTING AND PATCHING

A. Refer to Division 1 for "Cutting and Patching."

## 3.15 ACCEPTANCE

A. System can not be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
1. Testing reports including Contractor's Material and Test Certificate for Underground Piping, Contractor's Material and Test Certificate for Aboveground Piping, Contractor's Material and Test Certificate for Private Fire Service Mains, Fire pump acceptance test data report, and the like.
2. Cleaning.
3. Final acceptance by AHJ.
4. Operating and Maintenance Manuals.
5. Training of operating personnel.
6. Record Drawings.
7. Guaranty certificates.
8. Start-up and test document.
9. Letter of conformance.

## 3.16 LETTER OF CONFORMANCE

A. Provide letter of conformance and copies of manufacturers' warranties and extended warranties with a statement in letter that mechanical items were installed in accordance with manufacturer's recommendations. Include letter of conformance and copies of manufacturers' warranties and extended warranties in operating and maintenance manuals.

B. Warranties to begin at date of substantial completion.

**END OF SECTION**

# SECTION 21 01 00

# BASIC FIRE SUPPRESSION MATERIALS AND METHODS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work Included:
1. Materials, installation and testing of pipe, tubing, sprinklers, fittings, and valves.
2. Refer to Specification Sections for each system medium (i.e., standpipe and hose, fire suppression sprinkler systems, fire pumps, storage tanks for fire suppression, and the like) for product application.
3. Motors and starters.
4. Hanging and bracing.
5. Switches and supervisory devices.
6. Fire suppression identification materials.
7. Vibration and noise isolation.
8. Provide electrical connections and wiring as required for a complete and operable system. Includes, but is not limited to air compressors, sump pumps, fire pumps, jockey pumps, pump controllers, and the like.

### 1.2 QUALITY ASSURANCE

A. Manufacturer's Inspection: Inspect flanges, fittings and field applied welds in accordance with manufacturer's standard written quality control procedure in accordance with the following techniques: Visual Method: Comply with MSS SP-55 except as otherwise indicated.

B. Welding Qualification: Qualify welding procedures, welders and operators in accordance with ANSI B31.1 for shop and project site welding of piping work.

### 1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for:
1. Access panels.
2. Each type of:
   a. Pipe for underground and aboveground systems.
   b. Fitting: flanged, welded, mechanical, threaded gasket.
   c. Coupling.
   d. Attachment: Concrete anchor, lag screw, through-bolt, and the like.
   e. Sprinkler: Upright, pendent, sidewall, special, and the like.
   f. Sprinkler guard.
   g. Sprinkler escutcheon.
   h. Spare sprinkler box.
   i. Sway Bracing: Fittings, attachment, pipe, angle iron, and the like..
   j. Gauge.
   k. Fire department connection.
   l. Waterflow detector.
   m. Supervisory switch.
   n. Pressure switch.
   o. Meter: Water, flow, detector.
   p. Inspector's test connection.
   q. Alarm Bell: Electric and water motor activated.

r. Valve: Butterfly, rising stem gate, non-rising stem gate, globe, ball, drain, angle, automatic ball drip, check, backflow preventer, reduced-pressure backflow preventer, pressure relief, alarm, hydrant, testing, riser, sectional, fill, solenoid, and the like.
s. Control panel: fire pump, jockey pump, alarm, and the like.
t. Sign.
u. Hose cabinet.
v. Hose.
w. Nozzle.
x. Pump: Fire, jockey, sump, and the like.
y. Fire caulking.
z. Access panel.
aa. Miscellaneous: Solder, flux, glue, brazing filler.

B. Piping Materials List: Provide a typewritten list which schedules the piping materials to be used for each system as a function of applicable nominal pipe size ranges. Arrange schedule in outline form for each specific piping system, e.g., "Fire Sprinkler System," "Standpipe and Hose System," "Sway Bracing System," and the like. Include ASTM, ANSI, UL, FM Global or other numbers and other data as necessary to demonstrate compliance with requirements.

C. Test Procedure: Submit a typewritten checklist type of testing procedure indicating testing medium (i.e., water, air, nitrogen, and the like), pipe service, pipe and fitting type and classification, test pressure, pass/fail criteria and other pertinent data.

D. Maintenance Data: Submit maintenance data and parts list for each type valve. Include this data, product data, and certifications in operations and maintenance manual.

## PART 2 - PRODUCTS

### 2.1 PRODUCT STANDARDS

A. Material and Equipment: Listed for its intended use in current UL Fire Protection Equipment Directory, or UL Online Certifications Directory for Fire Protection, or FM Global Approval Guide, new and of current manufacture.

B. Where pressures are expected to exceed 175 PSI due to pressure regulating valve failure, provide products for high pressure or extra high pressure service.

C. Provide per AHJ requirements.

D. References to product Specifications for materials are listed according to accepted base standards. Materials to meet latest approved versions of these standards.

E. See Section 21 00 00, Basic Fire Suppression where piping materials are approved for use.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. General Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms, and other electrical or electronic equipment spaces and enclosures. Within equipment rooms, provide minimum 3-foot lateral clearance from sides of electric switchgear panels. Do not route piping above

electric power or lighting panel, switchgear, or similar electric device. Coordinate with electrical and coordinate exact pipe routing to provide proper clearance with such items.

B. Pressure Piping Routing:
1. Route piping, except as otherwise indicated, vertically and horizontally (sloped to drain). Avoid diagonal runs wherever possible. Orient horizontal routes parallel with walls and beam lines.
2. Install piping as shown or described by diagrams, details and notations on Drawings or, if not indicated, install piping to provide the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.
3. Support piping adjacent to walls, overhead construction, columns and other structural and permanent enclosure elements of the building. Limit clearance to 2 inches wherever furring is indicated for concealment of piping. Allow for insulation thickness. Locate insulated piping to provide minimum 1-inch clearance outside insulation.
4. Wherever possible in finished and occupied spaces, conceal piping from view by locating within column or beam enclosures, hollow wall construction, or above suspended ceilings. Do not encase horizontal routes in solid partitions, except where approved.

C. Preparation:
1. Insulating (Dielectric) Unions: Comply with manufacturer's instructions for installing unions wherever piping of dissimilar metals are adjoined. Install unions in manner which will prevent galvanic action and inhibit corrosion.
2. Couplings: Install where indicated on Drawings and on each side of pieces of equipment to permit easy removal of equipment.
3. Copper Tubing:
   a. Remove burrs from and clean outer surface of tube ends and inner surface of fittings.
   b. Copper-Soldered: Make soldered joints for copper tubing and fittings with code approved solder alloys meeting NFPA, ASTM and ANSI standards and listings. Solder-paste-flux combination fillers are not approved. Installations to conform to accepted published procedures; i.e., NFPA, UPC IS 375, IS 21-80 standards and CDA Publications. Use of steel wool for cleaning tube and fittings is prohibited. Apply flux as recommended by manufacturer. Solder fire suppression pipe within building above grade with 95 percent tin and 5 percent antimony, Allstate Silver Bearing Solder 430 or other approved solder alloys which do not contain lead or cadmium.
   c. Copper-Brazed: Make brazed joints for copper tubing and fittings with code approved brazing filler alloys meeting NFPA, ASTM and AWS standards and listings. Filler alloys of BCuP2 classification (e.g., "Phos-0" or "Fos-Copper") may not be used to make joints between copper tubing and cast brass or bronze fittings. Filler alloys containing cadmium are not approved for use in fire suppression water piping. Installations to conform to accepted published procedures, i.e., NFPA, UPC IS 3-75 standards and CDA Publications. Use of steel wool for cleaning tube and fittings is prohibited. Braze other copper pressure piping underground including water service. Remove bonnets and nonmetallic seats on valves and cool body with damp cloth while soldering or brazing. Remove excess flux from completed joints in accordance with manufacturer's instructions and code standards.
   d. Pressurized Service:
      1) Unless otherwise indicated, wrought copper/bronze solder joint fittings complying with ANSI B16.22-1995.
      2) Copper Tube Unions: Standard products as recommended by manufacturer for use in the service. Rated at 150 percent design

operating pressure.

3) Mechanically Formed Tee Connections:
   a) Form mechanically extracted collars in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Fully adjustable collaring device to ensure proper tolerance and complete uniformity of the joint.
   b) Notch the branch to conform with the inner curve of the run tube and dimpled to ensure penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube.
   c) Braze joints in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal. Note: Soft soldered joints will not be permitted.

e. Steel and Copper: Deburr cut edges.

D. Install products per UL listing or FM approval and per manufacturer's instructions.

## 3.2 PIPE AND PIPE FITTINGS

A. Pipe Sleeves:
1. Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1 inch above finished floor. Caulk pipes passing through floor with nonshrinking grout or approved caulking compound. Provide "Link-Seal" sleeve sealing system for slab on grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with nonshrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM Approved fire-rated firestopping compound. Provide fire-rated assemblies per local AHJ requirements.
4. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.

B. Conform with applicable codes and industry standards.

C. Install uninsulated piping so that unrestrained direct contact with the structure or other system installations is avoided. Where contact with or passage through building or structural features cannot be avoided; firmly anchor piping to, or isolated from, the structure to prevent noise transmission and occurrence of physical damage. Install piping to be insulated with adequate clearance around piping to allow for placement of full thickness insulating material.

D. Underground Steel Piping Corrosion Protection: Factory wrap uninsulated underground galvanized steel fire department connection piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating, equivalent to "Republic X-Tru-Coat." Wrap joints spirally with a minimum overlap of 1/2 tape width. Extend wrap not less than 3 inches above grade. Provide tinker test to check for holidays. Provide cathodic protection to meet requirements of governing authorities and servicing utility.

E. Expansion and Flexibility: Install work with due regard for expansion and contraction to prevent damage to the piping, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, sway bracing, wire restraints, vertical restraints, flexible couplings or other means to control pipe movement and to minimize pipe forces.

F. Install piping in concealed spaces above finished ceilings. Obtain Architect's and Engineer's approval of exposed piping prior to installation.

G. Coordinate support of pipe 4 inches and larger with structural engineer.

H. Provide clearances around piping per NFPA 13.

I. Coordinate installation with other trades. Route piping as required to avoid building structure, equipment, plumbing piping, HVAC piping, ductwork, lighting fixtures, electrical conduits and bus ducts and similar work. Final location of lighting will have priority over final sprinkler locations. Provide drains to trapped sections of system which result from such routing. Other trades take precedence for installation space.

## 3.3 ESCUTCHEONS

A. Install on exposed pipes passing through walls or floors.

## 3.4 PIPING AND EQUIPMENT REMOVAL

A. Piping and equipment removed as salvage by Owner to remain property of the Owner.

B. Comply with Division 02, Section "Selective Structure Demolition."

C. Remove as shown on drawings. Piping to be reused where shown. Dispose and remove excess piping equipment (and not identified by Owner as salvage).

## 3.5 ACCESSIBILITY

A. Installation of valves, gauges and equipment conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Access Panels: Label access panels with engraved nameplates indicating function of panel. Seton, Bakelite or approved. Nameplates to have 1/4-inch high white letters on red background, unless noted otherwise.

## 3.6 PAINTING

A. Machinery:
   1. In a mechanical room, on the roof or other exposed areas, piping and equipment except sprinklers to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
   2. See individual equipment specifications for other painting.

B. Structural Steel: Repair damage to structural steel finishes or the finishes of other materials damaged by cutting, welding or patching to match original.

C. Piping: Clean, primer coat, and paint exposed piping on the roof or at other exterior locations with two coats of paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

## 3.7 ACCESS PANELS

A. Install ceiling or wall access panels to provide access to concealed valves, drains, drum drips, test connections and other fire suppression items needing service. Provide access panels at locations required or as specified herein. Coordinate locations/sizes of access panels with Architect prior to work.

B. Where access panels are for service of valves, test connections, auxiliary drains, stencil the words "Fire Valve," "Inspector's Test Connection" or "Fire Auxiliary Drain " in 1/2-inch high capital letters on the outside of the panels.

## 3.8 FIRESTOPPING PENETRATIONS IN FIRE-RATED WALL/FLOOR ASSEMBLIES

A. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814 and NFPA.

B. Manufacturers: Hilti, Firetemp, or approved.

## 3.9 FIELD QUALITY CONTROL

A. Upon completion of installation of equipment, sprinklers, hose valves and piping and after units are water pressurized, test system to demonstrate capability and compliance with requirements. When possible, correct malfunctioning items at site, then retest to demonstrate compliance; otherwise, remove and replace with new items and proceed with retesting.

B. Inspect each installed item for damage to finish. If feasible, restore and match finish to original, except fire sprinklers, at site; otherwise, remove item and replace with new item. Feasibility and match to be judged by Architect. Remove cracked or dented items and replace with new items.

C. Fire sprinklers may not be reused, or cleaned, except for dusting. Replace damaged, field painted, oversprayed, overcoated or field coated sprinklers with new sprinklers of same manufacturer, model, finish, K-factor and performance characteristics. Where identical replacement sprinklers are not available, provide sprinklers of similar finish, style, K-factor and performance characteristics.

## 3.10 VALVE INSTALLATION

A. Install valves where required for proper operation, testing and drainage. Locate valves so as to be accessible and so that separate support can be provided when necessary.

B. Installation of Check Valves:
   1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.
   2. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.

C. Provide post indicator on buried control valves.

D. Provide listed backflow assembly at sprinkler system water source connection. Coordinate with local utility; conform to their installation requirements.

## 3.11 VALVE ADJUSTING AND CLEANING

A. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.

## 3.12 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve and control device in each piping system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.

B. Drain, Auxiliary Drain and Drum Drips: Provide valve tag on every valve in each fire suppression system. List each tagged valve and its location in valve schedule, identify on fire suppression drawings.

C. Install framed, glass or rigid transparent plastic covered, mounted valve schedule and valve location drawing in main riser or fire pump room.

D. Provide identification sign on ceiling tile below valve location.

## 3.13 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each item of fire suppression equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices: valves, drains, pumps, standpipes, tanks, similar equipment.

## 3.14 ADJUSTING AND CLEANING

A. Adjusting: Relocate fire suppression identification device which has become visually blocked.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

## 3.15 CONNECTIONS TO EXISTING

A. Prior to connection of piping to existing as illustrated on Plumbing Drawings, field verify existing conditions and exact sizes and locations of existing piping and ductwork. Provide additional offsets, transitions, joints, cut-ins, and replace portions of existing as required to facilitate connections of new as shown on Documents.

## 3.16 CAULKING

A. Provide Hilti FS-One High-Performance FireStop Sealant. ASTM E84-96, ICBO approved, Report No. ER-5071. Apply per manufacturer's recommendations.

## 3.17 FIRE DEPARTMENT CONNECTION

A. Fire Department Connection: Locate with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle. Provide method of draining FDC piping.

## 3.18 TEST CONNECTIONS

A. Route water supply flow test connections to a location which can accept the flow under wide-open flow and pressure for a sufficient time to assure a proper test, and which will not cause damage, including to landscaping.

## 3.19 COORDINATION

A. Coordinate location and electrical requirements for compressors, fire pumps, sump pumps, jockey pumps, pump controllers, heater cables, valve tamper switches, pressure switches, flow switches, alarm bells, pre-action system components and the like with Division 26.

## 3.20 CALCULATIONS

A. Hydraulic calculations include friction losses between the hydraulically most remote design area and the hydrant flow test pressure hydrant.

## 3.21 DRAINS

A. Locate drain connections within 7 feet of floor. Provide piping capable of being fully drained.

## 3.22 BELLS

A. Locate exterior alarm bells at 8 feet above finished grade. Coordinate with Architect.

## 3.23 FIELD SERVICES

A. Instruct the Owner in the operation of the sprinkler system, including main valve position (open or closed) recognition, system drainage, system testing, and the relation to the fire alarm system.

## 3.24 THERMAL EXPANSION/CONTRACTION

A. On shop drawings, show loops for expansion or contraction where piping is subjected to thermal expansion/contraction.

**END OF SECTION**

# SECTION 21 06 10

# SCHEDULES FOR WATER-BASED FIRE-SUPPRESSION PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 GENERAL

A. Material and Equipment: Listed for its intended use in current UL Fire Protection Equipment Directory, or UL Online Certifications Directory for Fire Protection, or FM Global Approval Guide, new and of current manufacture.

B. Refer to Specification Sections for each system medium (i.e., standpipe and hose, fire suppression sprinkler systems, fire pumps, and the like) for product application.

## PART 2 - PRODUCTS

### 2.1 PIPE AND FITTINGS

A. General: Provide per AHJ requirements, and as a minimum per section 21 06 10 Schedules for Fire Suppression.

B. Where pressures are expected to exceed 175 PSI due to pressure regulating valve failure, provide products for high pressure or extra high pressure service.

C. Materials: Domestic Manufacture.

### 2.2 PIPE AND FITTINGS FOR SPRINKLERS, STANDPIPES AND FIRE PUMP SYSTEMS

A. Buried Piping: Ductile iron Class 52, AWWA C151 or PVC, SDR-18, AWWA C900.

B. Aboveground Inside Building Piping:
1. Pipe Size 2-Inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; minimum CRR of 1.00 per UL listing or FM Global approval. Allied BLT/XL is not permitted.
2. Pipe Size 2-1/2-Inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum CRR of 1.00 per UL Testing or FM Global approved, wall thickness greater than Schedule 5 (Schedule 5 not approved).

C. Copper Pipe: ASTM B75, ASTM B88, ASTM B251. Threaded, brazed, solder or mechanical fittings only.

D. Mechanical Couplings: FM Global approved; Victaulic, Gruvlok, or approved.

E. Mechanical Gaskets: EPDM, Vic-Plus, Grade E+, or approved.

F. In-Building Riser: single extended 90 degree fitting of fabricated stainless steel tubing, maximum working pressure 175 psi. Grooved-end connection on building outlet side and CIPS coupler on underground inlet side. Ames In-Building Riser, or approved.

G. Expansion Loop: Two flexible sections for hose and braid. Metraflex FireLoop, or approved.

## 2.3 VALVES FOR SPRINKLERS, STANDPIPES AND FIRE PUMP SYSTEMS

A. OS&Y Gate:
   1. 2-1/2 Inches and Larger: Iron body. Nibco F-607-0, or approved.
   2. 2 Inches and Smaller: Bronze. Nibco T-104, or approved.

B. NRS Gate: Non-rising stem with indicator post. Nibco M/F-609 with NIP1A or equivalent for yard use and Nibco NIP2 or equivalent for wall use.

C. Swing Check: Iron body, rubber and bronze faced checks. Nibco F-908-W, or approved.

D. Wafer Check: Iron body, rubber seat, spring actuated. Nibco W-900-W, or approved.

E. Butterfly Valves: Ductile iron body, Nibco WD3510-8 with factory-installed tamper switches or approved. Use lug body next to pumps, LD-3510-6 or approved.

F. Pressure Relief for Grid System: Bronze body, stainless steel spring. Watts FP-53L, United Brass Works 132, or approved.

G. Indicator Posts: Pit mounting type, regular target type or wall target type. Kennedy, Nibco, or approved.

## 2.4 SPECIALTY PRODUCTS FOR SPRINKLER, STANDPIPE AND FIRE PUMP SYSTEMS

A. Pressure Gauges: 3.5-inch, Bourdon tube or spring type, 0 to 300 PSI. Ashcroft 1005P-XUL, US Gauge 1590K, or approved,

B. Waterflow Alarm Switch: Pressure actuated with SPDT electrical switches and adjustable time delay (0 to 75 seconds). Potter WFSR-F, or approved.

C. Waterflow Detector: Vane-type; SPDT switches; adjustable time delay (0 to 75 seconds). Potter VSR-F, or approved.

D. Supervisory Switches: Compatible with valve (OS&Y gate, butterfly, or PIV); SPDT switches. Potter, or approved.

E. Alarm Bells - Exterior: Minimum 90 dBA at 10 feet. Potter PB 8-inch, or approved.

F. Automatic Ball Drip Valve: Bronze, spring-type. Tyco F789, or approved.

G. Sway Bracing: From one m**anufacturer. Tolco, Afcon, or approved.**

## 2.5 HOSE STATION

A. Vertical breakaway peg type, Sierra XGT1, or approved.

B. Hose: 1-1/2-inch diameter, synthetic, rubber lined, 100-foot length.

C. Nozzle: Plastic combination fog to straight stream with shutoff.

## PART 3 – EXECUTION

Not Used.

**END OF SECTION**

# SECTION 21 13 00

# FIRE SUPPRESSION SPRINKLER SYSTEMS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. This is a bidder design system. Contact Authority Having Jurisdiction (AHJ) prior to bid to verify fire system requirements. Provide design compliant with codes as interpreted by AHJ.

B. Provide the following:
   1. New wet-pipe partial sprinkler system to protect Assembly Occupancies, including Multipurpose Room, Lobby and Cafeteria, Storage Rooms, Accessory spaces as required by code.
   2. Provide a new private fire service main, including connection to existing utility, and piping to the inlet connection inside the building. Provide required valves, backflow preventer, vaults, and appurtenances.
   3. Provide floor control stations, at each floor at the point of connection to the riser, controlling sprinklers on that floor. Floor control stations consist, at a minimum, of an indicating, supervised control valve, flow switch, pressure gauge, inspector's test connection and main drain connection.

C. Coordinate location and type of tamper, flow, and pressure switches, and the like with the fire alarm system.

D. Provide electrical connections and wiring as required for a complete and operable system. Includes, but is not limited to air compressors, fire pumps, jockey pumps, pump controllers, and the like.

E. Refer to Architectural, Structural, Mechanical, Plumbing, Electrical, and Civil Drawings for additional information relating to the fire sprinkler system

### 1.02 SYSTEM DESCRIPTION

A. Provide coverage building areas as indicated. Field verify field conditions prior to submittal of bid. Adjust bid to provide protection features in accordance with applicable codes and interpretations by AHJ. Provide design and installation based on the more stringent requirements if AHJ requirements differ from Code.

B. Design Parameters:
   1. Building Area: Assembly areas, Multipurpose, Lobby, Cafeteria
      a. Occupancy Classification: Light.
      b. Density: 0.10 GPM per sq.ft. over a 1500 sq.ft. hydraulically most remote design area per NFPA 13.
      c. Inside Hose Allowance: 0 GPM.
      d. Outside Hose Allowance: 100 GPM.
   2. Building Area: Storage Rooms, Accessory spaces as required by code.
      a. Occupancy Classification: Ordinary Group 2.
      b. Density: 0.20 GPM per sq.ft. over a 1500 sq.ft. hydraulically most remote design area per NFPA 13.
      c. Inside Hose Allowance: 0 GPM.
      d. Outside Hose Allowance: 250 GPM.
      e. Outside Hose Allowance: 100 GPM.
   3. Design parameters above are NFPA 13 minimums. Provide increased design densities, design areas, and hose allowances to meet requirements of AHJ.

C. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.

D. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant of flow test.

E. Develop cost-effective designs that may include the use of extended coverage sprinklers and design area reductions as allowed by NFPA 13.

## 1.03 REGULATORY REQUIREMENTS

A. The fire protection system requires Deferred Approval from Division of the State Architect. Project schedule shall allow for a 60 day DSA review cycle.

B. Fabrication of the fire protection system shall not be started until Contractor's Deferred Approval Submittal, including Shop Drawings, Specifications, and Engineering Calculations for the actual system to be installed have been accepted and signed by the Architect or Mechanical Engineer and approved by DSA.

## 1.03 FLOW TEST

A. Provide materials and labor for a new water supply test on the closest nearby fire hydrants per NFPA 13, and NFPA 291.

## 1.04 EXTRA STOCK

A. Provide extra sprinklers per code; provide suitable wrenches for each sprinkler type, and metal storage cabinet in riser room.

# PART 2 - PRODUCTS

## 2.01 GENERAL

A. Refer to Specification Section 21 06 10 for additional product information.

## 2.02 CONTROL VALVES

A. Sprinkler system control valves to be OS&Y or butterfly valves located inside building in 1-hour rated enclosure with outside door.

## 2.03 PIPE AND FITTINGS

A. Flexible Sprinkler Connectors: UL 2443. Fully welded, braided, leak tested sprinkler drop with a minimum internal corrugated hose diameter of 1-inch true-bore; and a one-piece ceiling bracket with removable attachment hub and self-securing integrated snap-on clip-ends, for attachment to a ceiling grid without the need for a screw fastener. Number of bends on flexible sprinkler connection fittings shall not exceed three. Minimum bend radius 3-inches. Flexhead.

## 2.04 SPECIALTY PRODUCTS

A. Inspector's Test Connection: Bronze, tamper and corrosion resistant orifice equivalent to smallest sprinkler orifice, sight flow connection. AGF TestAnDrain, or approved.

B. Floor Control Valve and Test Assembly: Control valve, water-flow alarm, sight glass, smooth bore orifice union of same size as smallest orifice sprinkler installed. Victaulic 747/747P, or approved.

## 2.05 SPRINKLERS

A. Finished Areas: Glass-bulb, recessed, quick-response pendent with white polyester finish, and white polyester escutcheon.

B. Nonfinished Areas: Glass-bulb, quick-response. Brass finish.

C. Dry: Recessed, glass bulb, quick-response, white polyester finish with chrome escutcheon.

D. Provide oversized escutcheons or flexible sprinkler connection fittings for pendent sprinklers to comply with building code and ASCE 7 seismic requirements for ceilings.

E. Provide guards for sprinklers located under ducts or other obstructions or for sprinklers located less than 8'-0" above finished floor or where subject to mechanical injury.

## 2.06 WET-PIPE SPRINKLER SYSTEMS

A. Hose Station: Sprinkler system design and hydraulic calculations to indicate point of connection to sprinkler piping.

# PART 3 - EXECUTION

## 3.01 INSTALLATION

A. Center sprinklers in the middle or quarter points of suspended ceiling tile.

B. Apply strippable tape or paper cover to ensure sprinklers do not receive field paint finish. Remove upon completion of painting.

C. Pendent sprinklers in areas subject to temperatures of greater than or less than 40F: Dry pendent type.

**END OF SECTION**

# SECTION 23 00 00

# BASIC HVAC REQUIREMENTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work Included: Work included in 23 00 00 applies to Division 23 work to provide materials, labor, tools, permits and incidentals to provide and make ready for Owner's use heating, ventilation, and air conditioning systems for proposed project.

B. Related Work Specified Elsewhere:
1. Contents of Section applies to Division 23 specifications.
2. Requirements of Section are a minimum for Division 23 Sections, unless otherwise stated in each Section, in which case that Section's requirements take precedence.

### 1.2 DEFINITIONS

A. Following is a list of abbreviations generally used in Division 23:

| | | |
|---|---|---|
| 1. | ADA | Americans with Disabilities Act. |
| 2. | AHJ | Authority Having Jurisdiction. |
| 3. | ANSI | American National Standards Institute. |
| 4. | ARI | Air-Conditioning & Refrigeration Institute. |
| 5. | ASHRAE | American Society of Heating, Refrigerating and Air-Conditioning Engineers. |
| 6. | ASME | American Society of Mechanical Engineers. |
| 7. | ASTM | American Society for Testing and Materials. |
| 8. | ASSE | American Society of Sanitary Engineering. |
| 9. | AWWA | American Water Works Association. |
| 10. | CBC | California Building Code. |
| 11. | CEC | California Electrical Code. |
| 12. | CGA | Canadian Gas Association. |
| 13. | CMC | California Mechanical Code. |
| 14. | CISPI | Cast Iron Soil Pipe Institute. |
| 15. | CSA | Canadian Standards Association. |
| 16. | ETL | Electric Testing Laboratories. |
| 17. | FM | FM Global. |
| 18. | HI | Hydraulic Institute Standards. |
| 19. | HVAC | Heating, Ventilating and Air Conditioning. |
| 20. | MSS | Manufacturers Standardization Society. |
| 21. | NEC | National Electric Code. |
| 22. | NEMA | National Electrical Manufacturers Association. |
| 23. | NFGC | National Fuel Gas Code. |
| 24. | NFPA | National Fire Protection Association. |
| 25. | NRCA | National Roofing Contractors Association. |
| 26. | NSF | National Sanitation Foundation. |
| 27. | OSHA | Occupational Safety and Health Administration. |
| 28. | SMACNA | Sheet Metal and Air Conditioning Contractors' National Association, Inc. |
| 29. | TEMA | Tubular Exchanger Manufacturers Association. |
| 30. | TIMA | Thermal Insulation Manufacturers Association. |
| 31. | UL | Underwriters Laboratories Inc. |

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

C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly and installation.

D. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at the project site as required to complete items of work furnished by others.

## 1.3 ADDITIONAL REQUIREMENTS TO DIVISION 01

A. Operation and Maintenance Documentation: Copies of certificates of code authority acceptance, test data, parts lists, maintenance information for equipment, valves, balancing reports, and other special guarantees, certificates of warranties, and the like, specified elsewhere herein or indicated on Drawings

B. Shop Drawings: Provide shop drawings which include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and the like. Refer to individual Specification Sections for additional requirements for the shop drawings.

C. Close-out Documentation: Submit mechanical code authority certification of inspection.

D. Record Drawings:
1. Show changes and deviations from the Drawings. Include issued Addendum and change order items.
2. Make changes to the Drawings in a neat, clean, and legible manner.

E. Product Data:
1. Submit manufacturer's technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, supplied or provided. Refer to individual specification sections for specific items required in product data submittal. Submit at one time in 3-ring binder, tabbed and referenced to match the Contract Documents.
2. Maintain an updated product submittal package to be included in the final operation and maintenance documentation.

## 1.4 QUALITY ASSURANCE

A. Where Contract Documents are at variance with applicable codes governing work, code and local jurisdiction requirements take precedence, and include cost necessary for code compliance or local jurisdiction compliance in bid price. Machinery and equipment to comply with Occupational Safety and Health Act of 1970, as currently revised, as interpreted for equipment manufacturer requirements.

B. Mechanical Drawings: Drawings are intended to be diagrammatic and are based on one manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., ducts and piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than basis of design, including but not limited to architectural, structural, electrical, fire sprinkler, and HVAC.

C. Requirements: As a minimum requirement, work in accordance with following rules and regulations and applicable laws:
1. NFPA.
2. OSHA.
3. Related supplements and standards.
4. California State Energy Code.
5. California Building Code.

6. California Mechanical Code.
7. California Plumbing Code.
8. California Fire Code.
9. State of California and local jurisdictional requirements.

D. Permits and Inspections:
1. Unless otherwise distinctly hereinafter specified, apply and pay for necessary permits, plans check, and inspections required by public AHJ.
2. Refer to General and Supplementary Conditions for payment of water and sewer service connection fees.
3. Obtain certificates of inspection from AHJs and deliver to Owner before final acceptance.
4. Each trade to consult local building department and utility companies prior to commencement of work to ascertain existence and location of existing underground utilities. Protect existing service against damage and interruption of use, and reroute as may be necessary to accomplish new work. Include costs for materials and installation for rerouting as specified for new work in bid price.

E. Regulatory Requirements:
1. UL and CSA Compliance: Provide units which are UL, ETL, and CSA listed.
2. ASME Compliance: Provide units which are ASME listed when boilers which exceed 200,000 BTUH, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

## 1.5 SEQUENCING AND SCHEDULING

A. For proper execution of work cooperate with other trades as needed.

B. To avoid installation conflicts, thoroughly examine complete set of Contract Documents. Resolve conflicts with Architect prior to fabrication and installation.

C. Prior to installation of equipment requiring electrical connections, examine manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that electrical characteristics indicated in Contract Documents are consistent with electrical characteristics of actual equipment being installed. When inconsistencies occur request clarification from Architect.

## 1.6 COORDINATION DOCUMENTS

A. Prepare and submit coordinated layout drawings, prior to construction, to coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, fire sprinklers, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system, and progressively number. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including electrical, ceiling suspension, and tile systems), and provide reasonable maintenance access requirements.

B. Prepare Drawings as follows:
1. Prepare Drawings to accurate scale of 1/4 inch = 1 foot or larger on Mylar sheets or AutoCAD. Drawings are to be same size as Contract Drawings and to indicate location, size and elevation above finished floor of HVAC equipment, ductwork, and piping. Drawings to also indicate proposed ceiling grid and lighting layout as shown on electrical drawings and reflected ceiling drawings.
2. Review and revise as necessary section cuts in Contract Drawings after verification of field conditions.

3. Indicate system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
4. Piping that must be graded to have right-of-way over more flexible items.
5. Drawings are to incorporate Addenda items and change orders.
6. Distribute drawings to trades and provide additional coordination as needed.

C. Advise Architect, in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Final coordination drawings with appropriate information added to be submitted as Record Drawings at completion of project.

### 1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, lights, and electrical services with architectural and structural requirements, and other trades (including electrical, ceiling suspension, and tile systems), and provide reasonable maintenance access requirements.

### 1.8 EXISTING SOILS CONDITIONS

A. Understand existing soils conditions before submitting bid on work. No additional allowance will be granted due to lack of information for existing conditions of subsurface soils.

B. Submission of a bid will be considered acknowledgment of review/understanding of project geotechnical soils report.

## PART 2 - PRODUCTS

### 2.1 HAZARDOUS MATERIALS

A. Do not use products containing asbestos, lead, arsenic, or any other material defined by EPA as hazardous to human or animal life.

### 2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials and equipment used for construction are to be new, the latest products as listed in manufacturer's printed catalog data and are to be UL or CSA approved or acceptable by state, county, and city authorities. Equipment supplier is responsible for obtaining state, county, and city acceptance on equipment not UL approved or not listed for installation.

B. Articles and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

## PART 3 - EXECUTION

## 3.1 ACCESSIBILITY AND INSTALLATION

A. Install equipment having components requiring access (i.e., drain pans, drains, fire dampers, control dampers, control operators, valves, motors, drives, and the like) so that they may be serviced, reset, replaced or recalibrated and the like, by service people with normal service tools and equipment. Notify Architect in writing if equipment or components are shown in such a position that above cannot be accomplished.

B. Install equipment complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment, examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods and sequencing, in coordination with other trades and disciplines.

C. Earthwork:
   1. Refer to Division 31.
   2. Perform excavation and backfill for installation of mechanical work.

D. Firestopping:
   1. Coordinate with Drawings location of fire rated walls, ceilings, floors and the like. When these assemblies are penetrated, seal around piping, ductwork, equipment, and the like, with approved firestopping material.
   2. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

## 3.2 SEISMIC CONTROL

A. Provide per Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

## 3.3 REVIEW BY ENGINEER

A. Notify Architect/Engineer, in writing, at following stages of construction so that Architect/Engineer may, at their option, visit site for review and construction observation:
   1. Underground piping installation prior to backfilling.
   2. Prior to covering walls.
   3. When ceiling installation is started.
   4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
   5. When ductwork installation starts.
   6. When installation starts for each different major type of equipment.
   7. When lines or ducts are to be permanently concealed by construction or insulation systems.
   8. When balancing and testing is started.

## 3.4 OPERATING DURING CHANGEOVER

A. During remodeling of existing structure, or addition of a structure to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.

B. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, wiring, and the like, to point of connection.

C. Perform actual transfer to new service at off-peak time, as coordinated with Owner. Once changeover is started, pursue it to its completion, to keep interference to a

minimum.

## 3.5 MUTILATION

A. Repair mutilation of building around pipes, ducts, and the like.

## 3.6 DEMOLITION

A. Scope:
   1. It is intent of these documents to provide necessary information and adjustments to mechanical system required to meet code, and accommodate installation of new work.
   2. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access, access to different areas.
   3. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.

B. Equipment: Unless otherwise directed, equipment or fittings being removed as part of the demolition process are the Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.

C. Unless specifically indicated on the Drawings, remove exposed, unused piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap piping and patch surfaces to match surrounding finish.

D. Unless specifically indicated on the Drawings, remove unused equipment, fittings, rough-ins, connectors, etc. Removal is to be to a point behind finished surfaces (floors, walls, ceilings, etc.).

## 3.7 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize mechanical equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

## 3.8 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

B. Maintain design intent where equipment other than as shown in Contract Documents is provided. Where equipment requires piping arrangement, control diagrams, or sequencing different from that indicated in Contract Documents, provide electrical motors, wiring, controls, or other required electrical components at no additional cost to Owner.

## 3.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and equipment in a manner to prevent damage and deterioration. Store in original container which identifies manufacturer's name, brand and model number. Do not store indoor equipment outdoors unless provided with a waterproof protective cover.

B. Replacement: In event of damage, immediately make repairs and replacements

necessary.

## 3.10 DEMONSTRATION

A. Upon completion of work and adjustment of equipment, test systems to demonstrate to Owner's Representative and Architect that equipment furnished and installed or connected under provisions of these Specifications functions mechanically in manner required.

B. Manufacturer's Field Services: Furnish services of a qualified person for a period of not less than sixteen hours, at a time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in a satisfactory manner and complies with requirements of other trades or Contractors that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

## 3.11 CLEANING

A. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated by this work.

## 3.12 INSTALLATION

A. Install equipment in accordance with manufacturer's installation instructions, plumb and level, firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

B. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
   1. Do not place equipment in sustained operation prior to initial balancing of mechanical systems.
   2. Furnish sufficient refrigerant and dry nitrogen for pressure testing under manufacturer's supervision.
   3. Provide and install additional fan sheaves to obtain design capacities. Coordinate exact requirements with balancing firm.

## 3.13 PAINTING

A. Ferrous Metal: After completion of mechanical work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, and the like, with one coat of black asphalt varnish or black enamel suitable for hot surfaces.

B. Machinery:
   1. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
   2. See individual equipment Specifications for other painting.
   3. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

C. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

## 3.14 CUTTING AND PATCHING

A. Refer to Division 1 for "Cutting and Patching."

## 3.15 ACCEPTANCE

A. System can not be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
   1. Testing and balancing reports.
   2. Cleaning.
   3. System balancing and balancing logs.
   4. Operating and Maintenance Manuals.
   5. Training of operating personnel.
   6. Record Drawings.
   7. Guaranty certificates.
   8. Start-up and test document.

## 3.16 LETTER OF CONFORMANCE

A. Provide letter and copies of extended warranties with a statement in letter that mechanical items were installed in accordance with manufacturer's recommendations. Include letter of conformance and warranties in operating and maintenance manuals.

B. Warranties to begin at date of substantial completion.

**END OF SECTION**

# SECTION 23 00 40

# ACCEPTANCE TESTING AND DOCUMENTATION

## PART 1 - GENERAL

### 1.1 SCOPE OF WORK

A. This section describes the Acceptance Testing and documentation of the mechanical system(s) and outlines the duties and responsibilities of the contracting team for Acceptance Testing.

B. Apply the Acceptance requirements to products, equipment and systems provided under this Division, where indicated on plans, and where required by California Title 24 requirements.

C. Engage the services of a firm specializing in commissioning of mechanical systems or shall submit contractor qualifications for review by architect where testing and documentation is to be performed by contractor. Where duct pressure testing validation is required, submit name and qualification for HERS Certified testing agency.

### 1.2 THE COMMISSIONING TEAM

A. Form the Commissioning Team of:
   1. Mechanical contractor's representative
   2. DDC Controls contractor's representative
   3. HERS Certified Testing Agency where required
   4. Inspector of record
   5. Owner's staff representative

## PART 2 - PRODUCTS

### 2.1 DUTIES OF THE TEAM

A. The duties of the Team are as outlined in the Title 24 Requirements and summarized below:
   1. Plan, organize and implement the Acceptance Testing process and within 1 month of the award of the contract, submit the names and addresses of the Testing team member(s).
   2. The Acceptance testing team shall submit a complete description of the testing procedures and systems to be tested to the architect for review.
   3. The Acceptance testing team shall coordinate tests of systems and equipment and assemble documentation related to tests. Submit documentation relative to tests and proposed procedures to design engineer for review prior to submitting documentation to Authority having Jurisdiction (AHJ.) Team responsible for performing data analysis, calculation of performance indices and crosschecking of results with the requirements of Title 24 and the Contract documents. The installing contractor or agent responsible for testing and documentation shall record their State of California Contractor's license number or their State of California Professional Registration License number on each Certificate of Acceptance for submittal.

4. Responsible for submitting Certificate of Acceptance including paper and electronic copies of measurements and monitoring results and supporting documentation to the AHJ. Where AHJ questions results or requires additional testing, complete additional testing and provide required documentation at no additional cost to the Owner.

## 2.2 TIME SCHEDULE

A. Determine the time period of the commissioning of the systems by the general contractor and Acceptance testing team. It is important to note that AHJ will not release a final Certificate of Occupancy until a Certificate of Acceptance is submitted that demonstrates that the specified systems and equipment have been shown to be performing in accordance with the Title 24 standards.

## 2.3 ACCEPTANCE TESTING – PHASE I - DOCUMENTATION

A. Team shall assemble documentation showing thermostat and sensor locations, control device locations, control sequences and notes.

B. Per Title 24 requirements, team shall provide record drawings to building owner within 90 days of receiving a final occupancy permit (refer to other specification sections for requirements on record drawings.)

C. Per Title 24 requirements, team shall provide operating and maintenance manuals to the building owner (refer to other specification sections for requirements on operation and maintenance manuals.)

## 2.4 ACCEPTANCE TESTING – PHASE II – INSPECTION AND TESTING

A. Team shall review the installation, perform acceptance testing and document results for the following systems:
1. Variable Air Volume Systems
2. Constant Volume Systems
3. Package Systems
4. Air Distribution Systems
5. Economizers
6. Ventilation Systems
7. Variable Frequency Drive Fan Systems
8. Hydronic Control Systems
9. System Programming

B. Review of installation shall confirm mechanical equipment and devices are properly located, identified, calibrated, and set points and schedules programmed per contract document requirements.

## 2.5 ACCEPTANCE TESTING - PHASE III - CERTIFICATION

A. Team shall document operating and maintenance information, complete installation certificate, and indicate test results on the Certificate of Acceptance, and submit the Certificate to the AHJ prior to receiving final occupancy permit. Team shall submit forms MECH-1-A through MECH-9-A as required by Title 24 requirements.

## PART 3 - EXECUTION

### 3.1 ACCEPTANCE TESTS AND DOCUMENTATION

A. Refer to California Title 24, Non-residential manual for specific testing procedures and documentation requirements. The detailed requirements can be found at http://www.energy.ca.gov/title 24/2005standards/index.html. Contractor is responsible for reviewing and complying with these standards

**END OF SECTION**

# SECTION 23 05 29

# HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work Included: Material and installation of supports, anchors and sleeves including: horizontal piping hangers and supports; vertical piping clamps; hanger rod attachments; building attachments; saddles and shields; miscellaneous metals, miscellaneous materials; roof equipment supports; anchors; equipment supports; wall and floor sleeves; and escutcheon plates.

### 1.2 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of supports and anchors, of types and sizes required.

B. Regulatory Requirements:
1. Provide pipe hangers and supports whose materials, design and manufacture comply with MSS SP-58, "Pipe Hangers and Supports - Materials, Design and Manufacture," latest edition.
2. Select and apply pipe hangers and supports complying with MSS SP-69, "Pipe Hangers and Supports - Selection and Application," latest edition.
3. A copy of the above-referenced standards on the construction site at all times.

C. Seismic: Provide per Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Manufacturers: B-Line, Elcen Metal Products Co., F&S Control, Globe, Kindorf, Kinline, Michigan, Superstrut, Unistrut, Power-Strut. Note: See individual Sections for roof equipment support.

### 1.3 SUBMITTALS

A. Submit the following:
1. Manufacturer's technical product data, including installation instructions, for each type of support, anchor and sleeve. Include UL approval drawing from manufacturer for each different pre-engineered firestop assembly.
2. Assembly type shop drawings for each type of sleeve, indicating dimensions, weights, required clearances, and methods of assembly of components.
3. Shop drawings for each individual roof pipe curb assembly, indicating number and location of each pipe or conduit which is to pass through the curb. Indicate pipe insulation requirements.

## PART 2 - PRODUCTS

### 2.1 PIPING HANGERS AND SUPPORTS

A. General:
1. Horizontal Piping Hangers and Supports-Horizontal and Vertical Piping, and Hanger Rod Attachments: Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one

type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for uninsulated copper piping systems.

2. Building Attachments: Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.
3. Saddles and Shields: Factory fabricated saddles or shields under piping hangers and supports for insulated piping. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12 inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
4. Roller Hangers: Adjustable roller hanger. Black steel yoke, cast iron roller.
5. Concrete Inserts: Malleable iron body, black finish. Lateral adjustment.
6. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.

B. Pipe Hangers Size 2 Inches and Smaller: Adjustable swivel ring hanger, UL listed. Michigan 100 or 101.

C. Pipe Hangers Size 2-1/2 Inches and Larger: Adjustable clevis type, UL listed. Michigan 400.

D. Riser Clamps: Steel, UL listed. Michigan 510 or 511. Copper coated; Michigan 368.

E. Plumbers Tape: Not permitted as pipe hangers or pipe straps.

F. Michigan numbers are indicated for type and quality. Comparable products manufactured by Globe, Elcen, B-Line, Kindorf, Kinline, Unistrut, Anvil, Super Strut, Tolco, PHD, Power-Strut, or approved.

## 2.2 ROOF EQUIPMENT SUPPORTS

A. General:
1. Coordinate the location and type of each roof equipment support with the roofing system supplier. Coordinate systems to maintain roof warranty.
2. Minimum 18 gauge galvanized steel with fully mitered and welded corners, internal bulkhead reinforcing, integral base plates, pressure-treated wood nailer, and 18 gauge galvanized steel counterflashing. Provide insulated curbs where surrounding roof is insulated.
3. Compensate for slope in roof so top of support is level.
4. Construct curb to withstand seismic forces.

B. Manufacturers:
1. Equipment Supports: Pate ES, Custom Curb, Vibrex, or Thycurb.
2. Equipment Curbs: Pate PC, Custom Curb, Vibrex, or Thycurb.
3. Pipe Curb Assemblies: Pate PCC, Custom Curb, Vibrex, or Thycurb.

## 2.3 WALL AND FLOOR SLEEVES

A. General:
1. "Link-Seal" Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Provide Type S unless otherwise noted. Thunderline Corporation, or approved.
2. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

3. Insulating Caulking: Eagle, Pitcher Super 66 high temperature cement, or approved.
4. Fabricated Accessories:
   a. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
   b. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide the following minimum gauges for the sizes indicated:
      1) Sleeve Size four Inches in Diameter and Smaller: 18 gauge.
      2) Sleeve Sizes five to six Inches: 16 gauge.
      3) Sleeve Sizes seven Inches and Larger: 14 gauge.
   c. Fire-Rated Safing Material:
      1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, six lbs./cu.ft. density with melting point of 1985F and K value of 0.24 at 75F.
      2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100F to 1200F service with K value of 0.40 at 150F.

## 2.4 ANCHORS

A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer.

B. Manufacturers: Anchor-It, Hilti Hit System, Epcon System, or Power Fast System.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Examine the Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

B. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.

## 3.2 INSTALLATION

A. Building Attachments: Install within concrete or on structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

B. Hangers and Supports:
1. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not support piping from other piping.
2. Support fire protection piping independently of other piping.

3. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
4. Allow controlled movement of piping systems to permit freedom of movement between pipe anchors and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
5. Piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
6. Insulated Piping: Provide protection saddles where insulation without vapor barrier is indicated. Provide protection shields on insulated piping where insulation with a vapor barrier is indicated.
7. Hanger Spacing:
   a. Steel Pipe 1 Inch and Smaller: 6 feet.
   b. Steel Pipe 1-1/4 Inches and Larger: 10 feet.
   c. Copper Tubing 1-1/2 Inches and Smaller: 6 feet.
   d. Copper Tubing 2 Inches and Larger: 10 feet.
   e. 90 Degree Offsets: Within 2 feet, both sides of offset.

C. Anchors: Install at ends of principal pipe runs where indicated on Drawings. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

D. Roof Equipment Supports, Equipment Curbs, and Pipe Curb Assemblies:
1. Provide prefabricated units for roof membrane and insulation penetrations related to mechanical equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
2. Equipment Supports: Provide for roof mounted equipment which does not require a structural roof deck penetration (i.e., condensing units).
3. Equipment Curbs: Provide for equipment which requires a structural roof deck penetration other than piping or conduit (i.e., fans, ducts).
4. Pipe Curb Assemblies: Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., refrigerant piping, electrical power and control wiring).
5. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise.

E. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

F. "Link-Seal" Pipe Sleeves: Install at exterior wall piping penetrations. For penetrations below grade provide Schedule 40 steel sleeve with 1-inch, continuously welded, "weep ring" centered on length of sleeve.

G. Fabricated Pipe Sleeves:
1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeves not to be more than 1 pipe size larger than piping or piping plus insulation size.
2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1/4 inch above floor finish and, where floor surface drains to a floor drain, extend floor sleeve 3/4 inch above floor finish.
3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
4. Seal each end airtight with a resilient nonhardening sealer.

H. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
   1. Install fabricated pipe sleeve.
   2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve I.D. with specified material.

I. Piping penetrations through fire-rated (1 to 3 hour) assemblies: Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.

## 3.3 ADJUSTING AND PAINTING

A. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.

B. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

## 3.4 FIRESTOPPING PENETRATIONS IN FIRE-RATED WALL/FLOOR ASSEMBLIES

A. Refer to Section 07 84 00.

B. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.

C. Manufacturers: Hilti, Proset, or approved.

**END OF SECTION**

# SECTION 23 05 93

# TESTING, ADJUSTING AND BALANCING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work Included: Materials, equipment and labor required for testing, adjusting, and balancing work required by this Section, including air, hydronic systems, and associated equipment and apparatus. The work consists of setting speed and volume (flow) adjustments, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required.

### 1.2 SCOPE OF WORK

A. Testing, adjusting, and Balancing (TAB) of the air conditioning systems and related ancillary equipment will be performed by a certified third party independent of the Contractor who specializes in testing, adjusting, and balancing of heating, ventilating, air-moving equipment and hydronic systems and has a minimum of 5 years experience in this specialty.

B. Make changes or replacements to the sheaves, belts, dampers, valves, etc. required for the correct balance as advised the TAB Firm, at no additional cost to the Owner.

C. The Drawings and Specifications indicate valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, provide access as requested by the TAB Firm. Correct equipment malfunction encountered during the balancing process.

D. Complete TAB services prior to Owner occupancy.

### 1.3 QUALIFICATIONS

A. Perform work of this Section by a firm certified by National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC).

B. Do work of this Section under the direct supervision of a person who has passed written and practical NEBB or AABC examinations for testing, adjusting, and balancing of air and hydronic systems.

### 1.4 QUALITY ASSURANCE

A. Codes and Standards:
   1. NEBB Compliance: Comply with NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus; or comply with AABC's Manual MN-1, "AABC National Standards," as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.
   2. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise indicated.

B. Personnel: TAB personnel used on the project will be employees of the Test and Balance Agency. Perform TAB work under the direct supervision of the NEBB or AABC Certified Test and Balance Supervisor.

C. Instrumentation:
1. List in balance report instrument description, serial number, and date of calibration.
2. Use instruments calibrated no longer than 1 year prior to report submission.

## 1.5 SUBMITTALS

A. Procedures: Submit certified test reports, signed by TAB supervisor who performed TAB work.

B. Qualification Statements: Submit company's certification documents including Contractor Certification and Supervisor certification.

C. Report Forms:
1. Submit copies of report forms to Architect within 30 days of award of the Contract by Owner prior to commencement of testing and balancing work at the site.
2. Provide 8-1/2- by 11-inch paper for looseleaf binding, with blanks for listing the required test ratings and for certification of report.
3. Submit reports on forms similar in content to standard AABC or NEBB test forms.
4. Submit final test and balance report. Include Record Drawings with terminal codes for cross-reference with the Submittal, such that terminals referenced in the Submittal are easily located on the Drawings.
5. Include identification and types of instruments used, and their most recent calibration date.
6. Submit resume data on person who is to directly supervise testing, adjusting and balancing work.

D. Maintenance Data: Include copies of balancing report and identification of instruments in maintenance manuals.

E. NEBB or AABC Certificate: At time of submittal of forms, submit NEBB or AABC certification form for review.

## 1.6 WARRANTY

A. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent of total number of terminals, or resetting of any outlet, coil, or device listed in the final TAB report.

B. Warranty shall meet the requirements of the following programs:
1. AABC – National Project Performance Guarantee
2. NEBB – Conformance Certification

# PART 2 - PRODUCTS

## 2.1 PATCHING MATERIALS

A. Ductwork and Housings: Use plastic plugs with retainers to patch drilled holes.

## 2.2 INSTRUMENTS

A. Utilize test instruments and equipment as recommended in the following:
   1. NEBB's Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
   2. AABC's Manual MN-1, "AABC National Standards."

# PART 3 - EXECUTION

## 3.1 VERIFICATION OF CONDITIONS

A. Perform TAB work with doors, closed windows, and ceilings installed, etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for testing, adjusting and balancing are clean and free from debris, dirt and discarded building materials.

B. Verify the following:
   1. Equipment is operable and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Final filters are clean and in place.
   4. Duct systems are clean of debris.
   5. Fan rotation is correct.
   6. Dampers are in place and open.
   7. Access doors are closed.
   8. Air outlets are installed and connected.
   9. Hydronic Systems have been flushed, filled, and vented.
   10. Proper strainer baskets are clean and in place.
   11. Service and balance valves are open.
   12. Any conditions affecting system operation, such as open doors, adjacent pressurized areas, and the like, are in final operating conditions prior to testing and balancing.

C. Report any defects or deficiencies noted during performance of services to Architect and Commissioning Agent. Promptly report abnormal conditions in Mechanical Systems or conditions which prevent system balance.

D. Automatic Temperature Control Systems:
   1. Set and adjust automatically operated devices to achieve required sequence of operations. Coordinate with the automatic temperature control supplier. Do not proceed without his representation.
   2. Verify controls for proper calibration and correct as necessary.

## 3.2 TEST HOLE LOCATIONS

A. Install test holes at the inlet and outlet of air handling unit fans, exhaust fans, utility fans, and the like, and elsewhere as required to facilitate traverses and to test the air systems. Plug holes when finished. Install test holes in air handlers to obtain test data for each component.

## 3.3 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, outside, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets. Log shows each successive test.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.

G. Adjust fans to deliver within 5 percent of specified flow. Adjust air outlets and inlets to within 10 percent of specified flow. Adjust to obtain balance with minimum fan speed possible.

H. Adjust fan for variable air volume systems with terminal units at 50 percent cooling airflow, opening terminal units at end of controlling duct run to achieve fan flow specified. Report final duct static pressure setpoint and supply fan and exhaust/return fan VFD speeds and frequencies.

I. Adjust outside air to fans as scheduled. Measure outside air for variable air volume fans at full flow. Adjust belt driven fan speeds to obtain necessary flow with variable frequency drive at 60 Hertz.

J. Adjust relief exhaust fans on variable air volume systems to maintain a positive building static pressure of 0.05 inch w.c. Verify and document calibration of building static pressure sensors.

## 3.4 AIR MOVING EQUIPMENT TESTING

A. Location.

B. Manufacturer.

C. Model.

D. Supply airflow, specified and actual.

E. Return airflow, specified and actual.

F. Outside airflow, specified and actual.

G. Total external static pressure, specified and actual.

H. Inlet pressure.

I. Discharge pressure.

J. Fan RPM.

## 3.5 EXHAUST FAN TESTING

A. Location

B. Manufacturer.

C. Model.

D. Airflow, specified and actual.

E. Total external static pressure, specified and actual.

F. Inlet pressure.

G. Discharge pressure.

H. Fan RPM.

## 3.6 RETURN AIR/OUTSIDE AIR TESTING

A. Identification/location.

B. Design airflow.

C. Actual airflow.

D. Design return airflow.

E. Actual return airflow.

F. Design outside airflow.

G. Actual outside airflow.

H. Return air temperature.

I. Outside air temperature.

J. Required mixed air temperature.

K. Actual mixed air temperature.

L. Design outside/return air ratio.

M. Actual outside/return air ratio.

## 3.7 ELECTRIC MOTORS TESTING

A. Manufacturer.

B. HP/BHP.

C. Phase, voltage, amperage; nameplate, actual, no load. Record voltage and amperage on all phases of 3 phase motors.

D. RPM.

E. Service factor.

F. Starter size, rating, heater elements.

## 3.8 V-BELT DRIVES TESTING

A. Identification/location.

B. Required driven RPM.

C. Driven sheave, diameter and RPM.

D. Belt, size and quantity.

E. Motor sheave, diameter and RPM.

## 3.9 DUCT TRAVERSE TESTING

A. System zone/branch.

B. Duct size.

C. Area.

D. Design velocity.

E. Design airflow.

F. Test velocity.

G. Test airflow.

H. Duct static pressure.

I. Air temperature.

J. Air correction factor.

## 3.10 AIR DISTRIBUTION TESTING

A. Air terminal number.

B. Room number/location.

C. Terminal type.

D. Terminal size.

E. Design velocity.

F. Design airflow.

G. Test (final) velocity.

H. Test (final) airflow.

I. Percent of design airflow.

## 3.11 TERMINAL UNIT TESTING

A. Manufacturer.

B. Type (i.e., constant, variable, single, dual duct).

C. Identification/number.

D. Location.

E. Model.

F. Size.

G. Minimum static pressure.

H. Minimum design airflow.

I. Maximum design airflow.

J. Maximum actual airflow.

K. Inlet static pressure.

L. Inlet and outlet temperature with heating valve open.

M. Coil water pressure drop, inlet and outlet temperatures and flowrate.

## 3.12 DUCT PRESSURE SENSOR (VAV SYSTEM) TESTING

A. Location.

B. Static pressure with fan at block load airflow.

## 3.13 WATER SYSTEM PROCEDURES

A. Adjust water systems to provide required or design quantities. Use calibrated orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on pressure drop across various heat transfer elements in the system.

B. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

C. Effect system balance with automatic control valves fully open to heat transfer elements.

D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shutoff valves for balancing unless indexed for balance point.

E. Adjust differential pressure on variable flow systems to minimum value that produces design flows to equipment.

## 3.14 COOLING COIL TESTING

A. Identification/number.

B. Location.

C. Service.

D. Manufacturer.

E. Airflow, design and actual.

F. Entering air DB temperature, design and actual.

G. Entering air WB temperature, design and actual.

H. Leaving air DB temperature, design and actual.

I. Leaving air WB temperature, design and actual.

J. Water flow, design and actual.

K. Water pressure drop, design and actual.

L. Entering water temperature, design and actual.

M. Leaving water temperature, design and actual.

N. Air pressure drop, design and actual.

## 3.15 HEATING COIL TESTING

A. Identification/number.

B. Location.

C. Service.

D. Manufacturer.

E. Airflow, design and actual.

F. Water flow, design and actual.

G. Water pressure drop, design and actual.

H. Entering water temperature, design and actual.

I. Leaving water temperature, design and actual.

J. Entering air temperature, design and actual.

K. Leaving air temperature, design and actual.

L. Air pressure drop, design and actual.

## 3.16 ADJUSTING

A. Recorded data represents actually measured or observed conditions. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops. Adjust air systems to deliver specified volumes with lowest possible fan speed.

## 3.17 DOMESTIC WATER

A. Adjust domestic water recirculation system to ensure hot water circulation in mains.

**END OF SECTION**

# SECTION 23 07 00

# HVAC INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Piping and Equipment Insulation: Materials and installation of insulation, jackets and accessories for the following applications:
   1. Chilled water piping systems.
   2. Heating water piping systems.

B. Ductwork Insulation: Materials and installation of duct insulation including the following applications: Air conditioning and heating ductwork.

### 1.2 QUALITY ASSURANCE

A. Qualification of Workers: Use proficient journeyman insulators and supervisors in the execution of this portion of the work to ensure proper and adequate installation of insulation throughout. A firm with at least 5 years successful installation experience on projects with installations similar to that required for this project.

B. Compliance with Specifications:
   1. Whenever required during progress of the work, furnish proof acceptable to the Owner that items installed are equal to or exceed requirements specified for this work.
   2. In the event such proof is not available, or is not acceptable to the Owner, the Owner may require the Contractor to remove the item or items and replace with material meeting the specified requirements and to repair damage caused in the removal and replacement, at no additional cost to the Owner.
   3. Install per manufacturer's written instructions.
   4. As a minimum, comply with appropriate state energy code or other applicable codes.

### 1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of insulation, jacket, glue, paint, fitting cover, and accessory. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each piping, equipment and duct system requiring insulation.

### 1.4 PRODUCT HANDLING

A. Protection: Use means necessary to protect insulation materials before, during and after installation.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary.

### 1.5 FIRE HAZARD CLASSIFICATION

A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a flame spread of 25, fuel contributed of 50 and smoke developed of 50 as tested by ASTM E84 (NFPA 255) method.

B. Test pipe insulation in accordance with the requirements of UL "Pipe and Equipment Coverings R5583 400 8.15."

C. Test duct insulation in accordance with ASTM E84 and bear the UL label.

## 1.6 LINING MATERIALS

A. Materials to be mold-, humidity-, and erosion-resistant surface that meets the requirements of UL 181.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Piping: Armacell LLC Armaflex, Certainteed, Imcoa, Johns Manville, Knauf, Nomaco, Owens-Corning, PPG, or approved.

B. Ductwork: Armacell LLC Armaflex, Certainteed, Johns Manville, Knauf, Owens-Corning, PPG, or approved.

## 2.2 TYPE 1, FIBERGLASS PIPE INSULATION

A. Glass Fiber: ASTM C547; rigid molded, noncombustible.
   1. Thermal Conductivity Value: 0.27 at 75F.
   2. Maximum Service Temperature: 850F.
   3. Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as needed.

## 2.3 TYPE 5, PLASTIC PIPE INSULATION

A. Flexible unicellular polyolefin foam insulation complying to ASTM C534, ASTM E84 (25/50), UL 723 (25/50). Thermal conductivity of 0.24 (BTU/in)/(hr/sq.ft./deg. F) at 75F. Preslit longitudinal seam. Imcoa, or approved.

## 2.4 TYPE 7, FLEXIBLE FIBERGLASS BLANKET

A. ASTM C553, Type 1, Class B-2; flexible blanket.

B. 'K' Value: 0.27 at 75F installed.

C. Density: 0.75 lb./cu.ft.

D. Vapor Barrier Jacket: FSK aluminum foil reinforced with fiberglass yarn and laminated to fire resistant Kraft, secured with UL listed pressure sensitive tape or outward clinched expanded staples and vapor barrier mastic as needed.

## 2.5 TYPE 8, DUCT LINER

A. ASTM C1071; flexible blanket.

B. 'K' Value: ASTM C518, 0.25 at 75F.

C. Noise Reduction Coefficient: 0.65 or higher based on "Type A mounting."

D. Maximum Velocity on Mat or Coated Air Side: 5,000 FPM

E. Adhesive: UL listed waterproof type.

F. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.

G. Mold-, Humidity-, and Erosion-Resistant Surfaces: UL 181.

## 2.6 JACKETING

A. PVC Plastic Fitting Covers: Schuller Zeston 2000. One-piece molded type fitting covers and jacketing material, gloss white. Connections: Tacks; pressure sensitive color matching vinyl tape.

B. Canvas Jacket: UL listed fabric, 6 oz/sq.yd., plain weave cotton treated with dilute fire retardant lagging adhesive.

## 2.7 ACCESSORIES

A. Equipment Insulation Jacketing: Presized glass cloth, not less than 7.8 ounces/sq.yd., except as otherwise indicated. Coat with gypsum based cement.

B. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

C. General: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have the same flame and smoke component ratings as the insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide nonwater soluble treatments.

## 2.8 PIPE FITTING INSULATION COVERS

A. PVC preformed molded insulation covers. Zeston, or approved.

## 2.9 DUCT INSULATION ACCESSORIES

A. Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

## 2.10 DUCT INSULATION COMPOUNDS

A. Cements, adhesives, coatings, sealers, protective finishes and similar accessories as recommended by insulation manufacturer for applications indicated.

# PART 3 - EXECUTION

## 3.1 VERIFICATION OF CONDITIONS

A. Do not apply insulation until pressure testing of the ducts has been completed. Do not apply insulation until the duct has been inspected.

B. Examine areas and conditions under which duct insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Clean and dry surfaces to be insulated.

## 3.3 INSTALLATION

A. Insulation: Continuous through walls, floors, partitions except where noted otherwise.

B. Piping and Equipment: Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that the insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until the piping has been leak tested and has passed such tests. Do not insulate chiller manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.

C. Ductwork:
1. Install insulation in conformance with the manufacturer's recommendations to completely cover the duct.
2. Butt insulation joints firmly together and install jackets and tapes smoothly and securely.
3. Apply duct insulation continuously through sleeves and prepared openings, except as otherwise specified. Apply vapor barrier materials to form a complete unbroken vapor seal over the insulation.
4. Coat staples and seals with vapor barrier coating.
5. Cover breaks in the jacket material with patches of the same material as the vapor barrier. Extend the patches not less than 2 inches beyond the break or penetration in all directions and secure with adhesive and staples. Seal staples and joints with brush coat of vapor barrier coating.
6. Fill jacket penetrations, i.e., hangers, thermometers and damper operating rods, and other voids in the insulation with vapor barrier coating. Seal the penetration with a brush coat of vapor barrier coating.
7. Seal and flash insulation terminations and pin punctures with a reinforced vapor barrier coating.
8. Continue insulation at fire dampers up to and including those portions of the fire damper frame which are visible at the outside of the rated fire barrier. Insulation terminations at fire dampers in accordance with the above.
9. Do not conceal duct access doors with insulation. Install insulation terminations at access doors in accordance with the above.
10. Duct Liners: Install mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with a continuous 100 percent coat of adhesive. For widths over 20 inches, additionally secure the liner with mechanical fasteners 15 inches on center. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation overlap sides. Keep duct liner clean and free from dust. At completion of project, vacuum duct liner if it is dirty or dusty. Cut studs off near washers. Do not use small pieces. If insulation is installed without horizontal, longitudinal, and end joints butted together, installation will be rejected and work removed and replaced with work that conforms to this Specification.
11. Duct Wrap: Cover supply air ducts except ducts internally lined. Wrap tightly with circumferential joints butted and longitudinal joints overlapped minimum of 2 inches. Adhere insulation with 4-inch strips of insulating bending adhesive at 8 inches on center. On ducts over 24 inches wide, additionally secure insulation with suitable mechanical fasteners at 18 inches on center. Circumferential and longitudinal joints stapled with flare staples 6 inches on center and covered with 3-inch-wide, foil reinforced tape.

## 3.4 PROTECTION AND REPLACEMENT

A. Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

## 3.5 FIBERGLASS INSULATION

A. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate the vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

B. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

## 3.6 PIPING SURFACES TO BE INSULATED

| Item to be Insulated: | System Insulation Type: | Pipe Size: | Insulation Thickness: |
|---|---|---|---|
| Aboveground heating and piping. | 1, 5 | Runouts up to 2"<br>All others | 1"<br>1-1/2" |
| Chilled, heating water valves. | 5 | N/A | 1" |
| Aboveground chilled, heating in Mechanical Room | 1, 5 | <2"<br>2-1/4 to 6"<br>6" | 1-1/2"<br>2"<br>2-1/2" |
| Condensate drain piping. | 1, 5 | all | 1/2" |

Note: Insulation thickness shown is a minimum. If state codes require additional thickness, then provide insulation thickness per code requirements.

## 3.7 DUCTWORK SURFACES TO BE INSULATED

| Item to be Insulated: | System Insulation Type: | Duct Size: | Insulation Thickness: |
|---|---|---|---|
| Supply ductwork (where duct is not specified to be lined). | 7 | all | 1-1/2" |
| Supply and return ductwork (in Mechanical Room). | 7 | all | 2" |
| Supply ductwork (where duct is specified to be lined) | 8 | all | 1" |

Note: Insulation thickness shown is a minimum. If state codes require additional thickness, then provide insulation thickness per code requirements.

## 3.8 INSULATED PIPE EXPOSED TO WEATHER

A. Where piping is exposed on roof, cover insulation with aluminum jacket. Seal watertight jacket per manufacturer's recommendations. Provide heat tracing on piping subject to freezing.

## 3.9 FLEXIBLE ELASTOMERIC TUBING

A. Slip insulation over piping or if piping is already installed, it should be slit and snapped over the piping. Joints and butt ends must be adhered with 520 adhesive.

## 3.10 INSULATION SHIELDS

A. Provide full size diameter hangers and shields (18 gauge minimum) for cold piping. Hot

water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 2 inches and larger (cold piping).

**END OF SECTION**

# SECTION 23 31 00

# DUCTWORK

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Materials, installation and testing of HVAC ductwork and accessories, including the following:
   1. Heating and air conditioning supply and return systems.
   2. Outside air systems.
   3. Exhaust systems.
   4. Ductwork hangers.
   5. Plenums.

### 1.2 QUALITY ASSURANCE

A. Unless otherwise noted, where the Specification refers to SMACNA in reference to sheet metal or flexible ductwork, this refers to HVAC Duct Construction Standards, Metal and Flexible, latest edition, as published by SMACNA.

B. Unless otherwise noted, where the Specification refers to TIMA in reference to fiberglass ductwork, this refers to Fibrous Glass Duct Construction Standards, latest edition, as published by TIMA.

C. Provide duct systems per CMC, latest edition, and all referenced standards.

D. Have available at the project field office a copy of the referenced standards.

### 1.3 SUBMITTALS

A. Provide shop drawings for duct materials, flues.

B. Submit duct pressure testing reports. Provide individual reports for each AHU duct system.

### 1.4 AIR DISTRIBUTION DUCT SYSTEM

A. General: All ductwork, including collars, register boxes, fire dampers, exhaust fans, ventilation louvers, roof vents and screens, as well as all dampers and any other miscellaneous items not specifically mentioned but necessary for a complete installation. Apply the latest standards of SMACNA and ASHRAE with respect to sheet-metal gauge and general construction for round and rectangular ducts.

## PART 2 - PRODUCTS

### 2.1 GALVANIZED SHEET-METAL DUCTWORK

A. General: CMC Duct Construction Standards, latest edition, or latest edition of ASHRAE Guide Table. 1-1/2 ounce galvanizing per square foot, both sides.

### 2.2 FLEXIBLE DUCTS

A. General: Comply with CMC, latest edition, Class 0 or Class 1.

B. Standard factory fabricated product, construct an inner wall of impervious vinyl or chlorinated polyethylene, permanently bonded to a vinyl or zinc-coated spring steel helix. Cover the assembly with fiberglass blanket insulation covered by an outer wall of vinyl or fiberglass-reinforced metalized vapor barrier. UL 181 listed Class 1 flexible air duct material. Overall thermal transmission no more than 0.25 (BTU/in)/(hr/sq.ft./deg. F) at 75F differential, per ASTM C335. Vapor transmission value no more than 0.10 perm, per ASTM E96. Rated for a minimum of 4-inch w.g. positive pressure and 1-inch w.g. negative pressure.

C. Air friction correction factor of 1.3 maximum at 1000 FPM. Working air velocity of at least 2000 FPM. Flame spread rating no more than 25. Smoke development rating no more than 50 as tested per ASTM E84. Must have cataloged data on insertion loss characteristics, minimum attenuation of 29 DB for 10-foot straight length at 8-inch diameter and 500 Hz.

D. Manufacturers: J. P. Lamborn Co., Norflex, Clevaflex, Genflex, Atco, Flexmaster, Thermaflex, or approved.

## 2.3 FACTORY FABRICATED METAL ROUND AND FLAT OVAL DUCTWORK

A. General: Provide per CMC Duct Construction Standards, latest edition, and ASTM A527 Class 0. Round sheet metal, spiral lock seam type. Fittings: Same construction as the duct. Tap in fittings not allowed. Duct sealer: Specifically formulated for sealing field joints for round spiral lock-seam duct systems.

## 2.4 SHEET-METAL DUCT SEALER

A. Hardcast "Duct-Seal 321" or United McGill. Indoor/outdoor, low VOC (<20 GPL), water based with fiber reinforcement.

## 2.5 PREFABRICATED DUCT JOINTS

A. Manufactured flanged traverse rectangular and round duct joints.

B. Manufacturers: Ductmate, Mez, Ward Duct Connectors, Lockformer TDC, or approved.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout as required to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, such alterations not to compromise the air flow, pressure drop, and sound characteristics of the duct fitting or run as shown on the Contract Drawings. Make such determination by Architect. In the event Architect determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Owner.

B. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Architect prior to any fabrication. Provide fittings construction per SMACNA.

C. Connect duct assemblies such as ductwork, plenums, etc., and operating machines or mechanisms such as fans, air conditioners, etc., with flexible connections per Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.

E. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.

F. Install single thickness turning vanes in square throat rectangular elbows and in tees. Provide 3/4-inch trailing edge on turning vanes, turned slightly past parallel to the duct.

G. Duct sizes indicated are free inside dimensions including where internal lining is shown.

H. Provide galvanized sheet-metal duct material for all ducts unless otherwise indicated or specified.

I. Provide temporary closures of open ducts during construction to prevent dust and debris from entering the system.

J. Flexible Duct:
1. Install flexible duct with bend radius equal to 1.5 times the diameter. Minimum length 2 feet. Maximum length 5 feet, unless noted otherwise.
2. Provide round neck grilles/diffusers or square-to-round transitions. No flex duct connections directly to square neck allowed.
3. Flex duct allowed only for vertical drops to diffusers. Maximum offset angle from vertical: 30 degrees.
4. Approved for use on supply ducts only; not allowed for return or exhaust.
5. Flex duct allowed in concealed spaces above lay-in ceilings only.

K. Fabricate ductwork and all sheet metal work of prime grade, lock forming quality steel in accordance with the current issues of the ASHRAE "Guide" and SMACNA standards and installed in strict conformance with SMACNA standards.

L. Submit shop drawings for approval for all ductwork. All ductwork to be sheet metal.

M. Construct ductwork upstream of VAV boxes for 4-inch pressure class; downstream duct 1-inch pressure class. All other duct 2-inch pressure class.

N. Round spiral duct and fittings or where required due to available clearances, use flat oval ductwork and fittings upstream of terminal units manufactured by United Sheet Metal, Rolok or approved in accordance with ASTM A527.

O. Seal all joints and seams in supply, exhaust, and return air ductwork and plenums.

P. Fabricate ductwork and plenums with a smooth inside surface and support and brace to prevent sagging and vibration at any time. Provide galvanized steel angles for reinforcing and bracing.

Q. Joints:
1. Carefully cut and trim all joints and seams in fabricated ducts and fitting to form a closed joint with no portion of the duct or fitting protruding into the air stream.
2. Seal all joints in sheet-metal ducts in concealed locations (such as enclosed ceiling spaces) with Hardcast joint sealant system applied in accordance with manufacturer's recommendations, or use Ductmate-type joints.
3. Seal all joints in sheet-metal ducts in exposed locations with sealant system applied in accordance with manufacturer's recommendations. Wipe off excess sealer on duct to give a clean finish, or use Ductmate-type joints.
4. Standard gray duct tape not allowed.

R. All fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.

S. Crimp flat duct surfaces diagonally or beaded regardless of size, unless acoustically lined.

T. Fabricate all duct size transitions with a slope of not more than 1 foot to 5 feet where possible, but in no case more than 1 foot in 3 feet.

U. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width. Where necessary, square elbows may be used, with maximum available inside radius and with fixed single thickness curved vanes, with trailing edge extended 3/4 inch.

V. Provide flexible connectors at connections to all equipment, in ducts crossing building expansion joints and may be used at connections of dissimilar metals. Flexible Connections: Minimum 16 ounce airtight "Ventglass" noncombustible fabric with fire retardant neoprene coating on outside, fastened with bolted galvanized steel bands. Maintain a minimum 1-inch space between the connecting surfaces.

W. Duct Hangers and Supports:
1. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 sq.ft. with galvanized strips of No. 16 USS gauge steel 1 inch wide, and all larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at 8 feet on center, as detailed.
2. Anchor all ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps to roof deck. Do not support ducts from other ducts or piping.
3. For round sheet-metal ducts, provide duct support in accordance with SMACNA Guidelines. Verify type of building construction.
4. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.
5. Do not install duct stiffeners on interior (air side) of unlined ductwork; install on exterior only or on interior of ductwork with duct liner.
6. Seismic Restraint: Brace all ductwork against lateral movement as detailed in document "Seismic Restraint Manual Guidelines for Mechanical Systems" as published by SMACNA.

X. Ductwork not to be supported from the roof deck. Hang ducts from beams, joists or supplementary structural members. Do not hang ductwork from joist bridging or from other ducts.

Y. Although not necessarily indicated on the Drawings, provide turning vanes at all mitered elbows, opposed blade balancing dampers with locking quadrants at branch ducts, volume extractors and any other applicable devices necessary for minimum duct resistance and proper system air balancing. Sufficiently stiffen all dampers to prevent noise or vibration and in no case be lighter than 20 gauge steel. Provide with accessibly located adjuster, manufactured by Young Regulator Co., Parker Kalon Corporation, or approved.

Z. Construct all exterior ductwork or ductwork which is otherwise exposed to weather watertight.

AA. Increase the size of all sheet-metal ducts as required to accommodate insulation lining.

BB. Locate access doors in ductwork as required for service of fire dampers, automatic dampers and other items requiring maintenance or inspection.

CC. Paint inside surface of all bare ductwork which is visible through face of grilles with flat black paint.

## 3.2 DUCTWORK PRESSURE TESTING

A. Provide air pressure testing of concealed ductwork systems (testing is not required for ductwork exposed to air conditioned space). Test ductwork prior to connection to fan equipment. Repair leaks and retest until stipulated results are achieved.
   1. Test at positive static pressure for 5 minutes with maximum air leakage not to exceed 1 percent of rated flow.
   2. Testing machine: Meet requirements of SMACNA standards. Pacific Air Products "Port-O-Lab," Rolok, United Sheet Metal, or approved.
   3. Test supply systems prior to connecting VAV boxes.
   4. Perform all tests in the presence of Owner's Representative. Give 48 hours advance notice before commencement of each test.
   5. Test ductwork systems in sections as large as possible and record all test results according.
   6. Coordinate testing with ceiling installation.
      a. Provide sheet-metal plates and install between each duct test section (applies to main-to-main fittings, branch-to-branch fittings and main-to-branch fittings). At each plate location, fabricate joint with Ductmate. Insert 14 gauge sheet metal between Ductmate using a neoprene gasket on both sides of metal plate.
      b. Leave plates in place until isolated section has been tested and approved by Owner's Representative.
      c. Once sections have passed test, remove plates and reattach Ductmate joints. After fan unit is running, test joint for leakage by using a mixture of soap and water. If any noise or bubbling occurs, reseal joint. Owner's representative to witness this procedure.
   7. Test duct at 1-1/2 times the design air pressure. Seal any audible leaks.

## 3.3 MOUNTING FOR SIDEWALL GRILLES AND REGISTERS

A. All mounting heights indicated on Drawings from finish floor to lower edge of grille or register. Exception: If note on Drawings states for example "Down 6 inches," this indicates measurement from ceiling to top edge of grille or register.

B. Install all sidewall return air grilles for "sight-tight" visibility at eye level (position blades to obscure visibility from floor level).

## 3.4 GRILLE AND EXPOSED DUCT CLEANING

A. After completion of ductwork installation, operate each fan system (excluding exhaust fans) for a minimum of 30 minutes prior to installation of ceiling grilles and diffusers. After grilles and diffusers are installed, clean out all accumulation of particles from grilles and diffusers prior to acceptance.

B. Clean exterior surface of all ducts exposed to public view of chalk, pencil and pen marks, labels, sizing tags, dirt, dust, etc., so that upon completion of installation, ducts are left in clean and unblemished manufactured condition.

C. All exposed duct and grilles shall remain free of dust entrained streaks due to leakage at joints and grille connections during warranty period. Clean leaks, seal and refinish to match existing if visible streaks develop.

**END OF SECTION**

# SECTION 23 33 00

# DUCTWORK ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work Included: Materials, installation, and testing of HVAC duct accessories such as volume dampers, splitter dampers, adjustable deflectors, duct access doors, backdraft dampers, fire dampers, duct silencers, spin-in fittings, and smoke dampers.

### 1.2 QUALITY ASSURANCE

A. Provide fire dampers in conformance with the requirements of Fire Damper and Heat Stop Guide for Air Handling Systems, as published by SMACNA.

### 1.3 SUBMITTALS

A. Submit manufacturer's catalog data and fabrication/installation drawings for each factory fabricated duct accessory.

## PART 2 - PRODUCTS

### 2.1 DAMPERS

A. Volume Dampers (VD):
   1. Construct of galvanized sheets not lighter than 18 gauge, reinforced to prevent vibration, equipped at both ends with brass bearing mounts and of sufficient length to provide a complete shutoff of the duct.
   2. Provide each damper with an adjustment and locking quadrant device manufactured by Young Regulator Co., No. 403 operator for accessible locations, or No. 315 for nonaccessible locations. Ventlock, or approved. Provide operating rod and attaching devices as required for No. 315 operator. Provide Young Regulator No. 443 or 443B raised platform for insulated duct.

B. Register Dampers: Dampers utilized with grilles. Opposed blade dampers utilizing a side operated worm drive which provides external duct operation. Slot the end of the shaft to receive a screwdriver. Factory assembled side operator. Construct of the same material as the grille. Manufacturers: Same as grilles and diffusers. Provide Young Regulator 443 or 443B raised platform for insulated duct.

C. Control Dampers: Provide automatic control dampers as indicated. Airfoil, multiblade type, maximum blade length of 48 inches. Provide parallel blades for positive or modulating mixing service and opposed blades for throttling service. Blades to be interlocking, minimum 16 gauge galvanized steel. Damper blades reinforced, have continuous full length axle shafts and/or operating jackshafts as required to provide coordinated tracking of blades. Dampers over 25 sq.ft. in area to be in two or more sections, with interconnecting blades. Dampers to have a maximum air leakage of 15 CFM psf at 4-inch w.g. pressure. Provide automatic dampers except those specified with units. Manufacturers: Louvers & Dampers, Ruskin, Cesco, Greenheck, Prefco, or approved.

### 2.2 DUCT ACCESS DOORS

A. Gasketed, hinged or removable, rated for operating pressure. Ductmate "Sandwich" for rectangular ductwork or "Metu" for round ductwork, or approved.

## PART 3 - EXECUTION

### 3.1 VOLUME DAMPERS

A. Provide in main duct branches where shown. Provide in branch ducts serving air inlets and outlets.

B. Locate dampers as close to trunk or main branch as possible.

### 3.2 DUCT ACCESS DOORS

A. Install where shown and required by SMACNA. Provide on the reset side of all fire dampers and adjacent to duct mounted automatic dampers. Install per manufacturer's recommendations.

B. Where access doors are for service of fire or smoke dampers, stencil the words "Fire Damper" or "Smoke Damper" in 1/2-inch high capital letters on the outside of the door.

**END OF SECTION**

# SECTION 23 37 00

# AIR OUTLETS AND INLETS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work Included: Materials, installation, and testing of HVAC outlets and inlets.

### 1.2 QUALITY ASSURANCE

A. Components: Tested, rated and certified per Air Diffusion Council procedures.

B. Air Movement and Control Association Int'l (AMCA) Compliance: Test and rate louvers in accordance with AMCA 500, "Test Method for Louvers, Dampers and Shutters." Provide louvers bearing AMCA Certified Rating Seal.

### 1.3 SUBMITTALS

A. Manufacturer's catalog data on each of the following:
   1. Type of register, diffuser, grille, frame, louver, and dampers.
   2. Schedule of air outlets and inlets indicating drawing designation, model number and accessories furnished.

## PART 2 - PRODUCTS

### 2.1 GRILLES, REGISTERS, DIFFUSERS

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

B. Provide 1-, 2-, 3-, or 4-way deflection as indicated.

C. Register Dampers: Dampers utilized with grilles. Opposed blade dampers utilizing a side operated worm drive which provides external duct operation. Slot the end of the shaft to receive a screwdriver. Factory assembled side operator. Construct of the same material as the grille. Manufacturers: Same as grilles and diffusers.

D. Coordinate mounting frames with construction types per finish schedule.

E. Performance: Provide components that have velocity, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current standard literature, which are plus or minus 10 percent of the components as listed in the Diffuser, Register and Grille Schedule, or as specified herein.

F. Manufacturers: Agitaire, Air Concepts, Anemostat, Carnes, Connor, Environmental Air Products, Hart & Cooley, J&J Register, Krueger, Metalaire, Nailor, Price Co, Shoemaker, Titus, Tuttle & Bailey, Seiho.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install grilles, registers, and diffusers per manufacturer's instructions. Locate and size

openings through finished surfaces to provide complete coverage of rough openings by integral device flanges or auxiliary frames.

B. Paint exterior of devices per color selected by Architect.

C. Coordinate duct connections with device final dimensions. Provide square to round adapters where required for connection to round ducts.

D. Adjust the throws of air outlets to eliminate drafts.

**END OF SECTION**

# SECTION 26 00 00

# BASIC ELECTRICAL REQUIREMENTS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes:

1. Electrical systems required for this work includes labor, materials, equipment, and services necessary to complete installation of electrical work shown on Drawings, specified herein or required for a complete operable facility and not specifically described in other Sections of these Specifications. Among the items required are:
   a. Distribution equipment.
   b. Feeders to distribution panels, HVAC equipment, Owner provided equipment and other equipment.
   c. Branch circuit wiring from distribution panels for lighting, receptacles, motors, signal systems, and other detailed wiring.
   d. Luminaires, control switches, receptacles, relays, supports, and other accessory items.
   e. Wiring and power connections for motors installed for heating, cooling, and ventilation.
   f. Fire alarm system.
   g. Low voltage systems.

### 1.02 DEFINITIONS

A. Following is a list of abbreviations generally used in Division 26:

| | | |
|---|---|---|
| 1. | ADA | Americans With Disabilities Act |
| 2. | AHJ | Authority Having Jurisdiction |
| 3. | ANSI | American National Standards Institute |
| 4. | APWA | American Public Works Association |
| 5. | ASTM | American Society for Testing and Materials |
| 6. | CBC | California Building Code |
| 7. | CEC | California Electrical Code |
| 8. | CFC | California Fire Code |
| 9. | FCC | Federal Communications Commission |
| 10. | HVAC | Heating, Ventilating and Air Conditioning |
| 11. | IEC | International Electrotechnical Commission |
| 12. | IEEE | Institute of Electrical and Electronics Engineers. |
| 13. | IETA | International Electrical Testing Association |
| 14. | FM | FM Global |
| 15. | NEMA | National Electrical Manufacturers Association |
| 16. | NFPA | National Fire Protection Association |
| 17. | OSHA | Occupational Safety and Health Administration |
| 18. | UL | Underwriters Laboratories Inc. |

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

C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly and installation.

D. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at the project site to complete items of work furnished by others.

## 1.03 ADDITIONAL REQUIREMENTS TO DIVISION 01

A. Operation and Maintenance Documentation: Provide copies of certificates of code authority acceptance, test data, product data, guarantees, warranties, and the like.

B. Shop Drawings: When requested by individual Sections provide shop drawings which include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and the like. Refer to individual Specification Sections for additional requirements for the shop drawings.

C. Closeout Documentation: Submit electrical code authority certification of inspection. Include documentation of on-site electrical testing that was performed.

D. Record Drawings:
1. Show changes and deviations from the Drawings. Include written Addendum and change order items.
2. Show exact routes of feeders 100 amp and larger; and service entrance conduits.
3. Show exact location of switchboards, distribution panelboards, safety disconnects, motor controllers, and the like.
4. Make changes to drawings in electronic format. Obtain electronic copy from Architect, use the same version of AutoCAD to prepare record drawings as was used by the Architect. Provide electronic copy and hard copy to Architect for review.
5. Provide a full size Record Drawing of the one-line power diagram sealed in a plastic coating. Mount on the wall of the electric room.

## 1.04 QUALITY ASSURANCE

A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.

B. Conform to latest adopted version of the CBC with amendments by local AHJs.

C. Obtain and pay for electrical permits and inspections from local AHJs.

D. Furnish products listed by UL or other testing firm acceptable to AHJ.

## 1.05 SEQUENCING AND SCHEDULING

A. For the proper execution of the work cooperate with other crafts and contracts as needed.

B. To avoid installation conflicts, thoroughly examine the complete set of Contract Documents. Resolve conflicts with Engineer prior to installation.

C. Prior to installation of feeders to equipment requiring electrical connections, examine the manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that the electrical characteristics detailed in the Contract Documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Engineer.

# PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

A. Provide like items from one manufacturer, such as luminaire types, switches, receptacles, breakers, panels, and the like.

## 2.02 MATERIALS

A. Provide new electrical materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established. Indicated brand name and catalog numbers are used to establish standards of performance and quality. The description of materials listed herein governs in the event that catalog numbers do not correspond to materials described herein.

B. Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide wet labeled equipment in locations that are wet.

C. Include special features, finishes, accessories, and other requirements as described in the Contract Documents regardless of the item's listed catalog number.

D. Provide incidentals not specifically mentioned herein or noted on Drawings, but needed to complete the system, in a safe and satisfactory working condition.

## 2.03 FIRESTOPPING

A. Foam Sealant: Foam sealant for use around conduit penetrations to prevent passage of smoke, fire, toxic gas or water. Maintain seal before, during and after fire. In and around conduit for thermal break at penetration of barrier between heated and unheated spaces. Chase Technology Corporation, Fire Foam, Thomas & Betts, or approved.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Construction Documents:
   1. Drawings are diagrammatic with symbols representing electrical equipment, outlets, luminaires, and wiring.
   2. Electrical symbols indicating wiring and equipment shown in the Contract Documents are included in the Contract unless specifically noted otherwise.
   3. Examine the entire set of Drawings to avoid conflicts with other systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction.

B. Clarification:
   1. The Drawings govern in matters of quantity, the Specification in matters of quality. In event of conflict on Drawings or in the Specifications, the greater quantity and the higher quality apply.
   2. Should the Electrical Documents indicate a condition conflicting with the governing codes and regulations, refrain from installing that portion of the work until clarified by Engineer.

## 3.02 INSTALLATION

A. Install electrical equipment complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of the electrical equipment, examine the instructions thoroughly. When requirements of the installation instructions conflict with the Contract Documents, request clarification from Engineer prior to proceeding with the installation.

B. Do not install electrical equipment in obvious passages, doorways, scuttles or crawl

spaces which would impede or block the area passage's intended usage.

C. Noise Control:
1. Do not install outlet boxes back to back. Do not use straight through boxes.
2. Do not place contactors, transformers, starters and similar noise producing devices on walls which are common to occupied spaces unless specifically called for on Drawings. Where such devices must be mounted on walls common to occupied spaces, mount or isolate in such a manner as to effectively prevent the transmission of their inherent noise to the occupied space.

D. Firestopping:
1. Coordinate with the Drawings the location of fire rated walls, ceilings, floors and the like. When these assemblies are penetrated by electrical equipment, seal around the equipment with approved firestopping material.
2. Install firestopping material complete as directed per the manufacturer's installation instructions.

## 3.03 FIELD QUALITY CONTROL

A. Tests:
1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified in Division 26. Refer to individual Specification Sections for required tests. Document tests and include in Closeout Documents.
2. During site evaluations by Engineer, provide an electrician with tools to remove and replace trims, covers, devices, and the like, so that a proper evaluation of the installation can be performed.

## 3.04 CLEANING

A. Remove dirt and debris caused by the execution of the electrical work.

B. Leave the entire electrical system installed under this Contract in clean, dust-free and proper working order.

C. Vacuum clean interiors of all new and modified electrical signal and communication equipment enclosures.

## 3.05 DEMOLITION

A. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access, access to different areas. The Owner will cooperate to the best of their ability to assist in a coordinated schedule, but will remain the final authority as to time of work permitted.

B. Examination: Determine the exact location of existing utilities and equipment before commencing work, compensate the Owner for damages caused by the failure to locate and preserve utilities. Replace damaged items with new material to match existing.

C. Promptly notify Owner if utilities are found which are not shown on Drawings.

D. Execution:
1. Remove existing luminaires, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.
2. Maintain electrical continuity of existing systems. Remove or relocate electrical boxes, conduit, wiring, equipment, luminaires, and the like, as encountered in

removed or remodeled areas in the existing construction affected by this work.

3. Remove and restore wiring which serves usable existing outlets clear of the construction or demolition.
4. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass the abandoned outlets.
5. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of the construction or demolition and maintain service to the existing load.
6. Extend circuiting and devices in existing walls to be furred out.
7. Remove abandoned wiring to leave site clean.
8. If existing electrical equipment contains PCBs (polychlorinated biphenyl), replace with new. Dispose of material containing PCBs as required by federal and local regulations.
9. Repair adjacent construction and finishes damaged during demolition work.
10. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

## 3.06 CONTINUITY OF SERVICE

A. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from the Owner. Requests for outages shall state the specific dates and hours and the maximum durations, with the outages kept to these specific dates and hours and the maximum durations. Obtain written permission from the Owner for any interruption of power, lighting or signal circuits and systems.

B. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work, due to maintaining continuity of service herein required.

C. Organize work to minimize duration of power interruption.

**END OF SECTION**

# SECTION 26 01 00

# BASIC MATERIALS AND METHODS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes:
1. Raceways.
2. Wires, cables and connectors.
3. Outlet boxes.
4. Devices and plates.
5. Surface raceway system.
6. Identification.
7. Safety disconnect switches.

### 1.02 SYSTEM DESCRIPTION

A. Provide raceways, wires, cables, connector, boxes, devices, finish plates and the like for a complete and operational electrical system.

B. Electrical Connections: Connect equipment, whether furnished by Owner or other Divisions of the Contract, electrically complete.

C. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with Seismic Zone 4 requirements.

### 1.03 SUBMITTALS

A. Provide shop drawings and product data for the following:
1. Raceways.
2. Wires, cables and connectors.
3. Surface raceway system.
4. Identification equipment.
5. Safety disconnect switches.

B. Provide the following operating and maintenance instructions from the manufacturer for project closeout, see project closeout requirements in Division 01:
1. Devices and plates.
2. Safety disconnect switches.

### 1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.

B. Furnish products listed by UL or other testing firm acceptable to AHJ.

## PART 2 - PRODUCTS

### 2.01 RACEWAYS

A. Conduits:
1. Galvanized Rigid Steel Conduit (GRC): Hot-dip galvanized after thread cutting. Manufacture in conformance with Federal Specification WWC-581 and ANSI C80.1.
2. Electrical Metallic Tubing (EMT): Hot-dip galvanized and chromate coated. Manufacture in conformance with Federal Specification WWC-563 and ANSI C80.3.
3. Flexible Conduit: Reduced wall flexible steel conduit. Hot-dip galvanized. Manufacture in conformance with Federal Specification A-A-55810.
4. Flexible Conduit, PVC Coated: Hot-dip galvanized steel. PVC chemical resistant jacket extruded to core, up to 1-inch trade size. PVC chemical resistant jacket, tubed over core, up to 4-inch trade size.

B. Conduit Fittings:
1. Bushings: Malleable iron with plastic insulator lining, 150C rated.
2. Ground Bushings: Malleable iron with plastic insulating liner and aluminum grounding lug rated for copper or aluminum conductor, 150C rated.
3. EMT Connectors and Couplings: Compression Type: Zinc plated steel, insulated throat connectors, raintight up to 2 inches.
4. Rigid Steel Conduit Ells: PVC coated or painted with No. 51 bitumastic material, long radius ells, minimum radius of 36 inches.
5. Expansion/Deflection Fittings:
   a. EMT: Use O-Z Gedney Type TX.
   b. GRC: Use O-Z Gedney Type AX, DX and AXDX.

### 2.02 WIRES AND CABLES

A. Copper, 600 volt rated throughout. Conductors 14AWG to 10AWG, solid. Conductors 8AWG and larger, stranded. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back. Conductors 3AWG and larger, minimum insulation rating of 75C. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits. Color code conductors as follows:

| PHASE | 208 VOLT WYE | 240 VOLT DELTA | 480 VOLT |
|---|---|---|---|
| A | Black | Black | Brown |
| B | Red | Orange (High Leg) | Orange |
| C | Blue | Blue | Yellow |
| Neutral | White | White | Gray |
| Ground | Green | Green | Green |
| Isolated Ground | Green w/yellow trace | N/A | N/A |

B. Service Entrance Cable: Copper conductor, 600 volt insulation, XHHW, Type SE.

### 2.03 CONNECTORS

A. Copper Pads: Drilled and tapped for multiple conductor terminals.

B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors. Manufacturers: Anderson, Ilsco, Panduit, Thomas & Betts, 3M, or approved.

C. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 18 through 8AWG. Push-in type connectors where conductors are not required to be twisted

together are not acceptable. Manufacturers: 3M, Ideal, or approved.

## 2.04 BOXES

A. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

B. Weatherproof Outlet Boxes: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket, blank plugs and corrosionproof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish. Bell, Carlon, Red Dot, or approved.

C. Junction and Pull Boxes: Provide ANSI 49 gray enamel painted sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers. Circle AW, Hoffman, or approved.

D. Box Extension Adapter: Die-cast aluminum construction. Install over flush wall outlet boxes to permit flexible raceway extension to equipment. Bell 940 Series, Carlon, Red Dot IHE4 Series, or approved.

E. Conduit Fittings: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation. O-Z Gedney, Thomas & Betts, or approved.

## 2.05 WIRING DEVICES

A. Wall Switches: Toggle Type Characteristics: Quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage. Cooper 1221, Leviton 1221, Hubbell 1221, Pass & Seymour 20ACI.

B. Receptacles:
1. Finish: Same exposed finish as switches.
2. Duplex Receptacle Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding. Industrial Grade: Back and side wired. Single piece, rivetless. Brass grounding system and mounting strap. 20 amp. Cooper 5362, Hubbell 5362, Leviton 5362A, Pass & Seymour 5362A.
3. Ground Fault Circuit Interrupter (GFCI) Receptacle: Meets or exceeds UL943 (Class A GFCI), UL498. Feed through type, back-and-side wired, 20 amp, 125VAC, Cooper XGF20, Hubbell GF5362, Leviton 8898, Pass & Seymour 2094.
4. UL Wet-Listed Covers While-In-Use: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit. UV stabilized polycarbonate cover with closed cell neoprene foam gasket. Pass & Seymour WIUC10, Leviton 5977, Hubbell WP826MP, Cooper 4966.
5. Special Purpose Receptacles: Refer to drawings for NEMA Standard Specification.

C. Finish Plates: Match district standard.

D. Surface Covers:
1. Material: Galvanized or cadmium plated steel, 1/2-inch raised industrial type with openings appropriate for devices installed in surface outlets.

2. Cast Box and Extension Adaptors: Aluminum, with gasket, blank. One gang, Bell 240-ALF, Carlon; two gang, Bell 236-ALF, Carlon, or approved.

## 2.06 SURFACE RECEPTACLE/SIGNAL RACEWAY SYSTEMS

A. Two-Channel Surface Raceway: One channel for power, the other channel for signal. Provide 20 amp multi-circuit as indicated on drawings. Provide divider between channels. Wiremold V4000 Series, or approved.

B. Provide lengths taken from drawings to a tolerance of 1/2 inch over raceway length between end wall surface. Do not scale from Division 26 Drawings.

C. Provide prewired receptacles every 24 inches unless otherwise noted on drawings.

D. Provide endcaps, corner joints, tees, transition fittings, and the like, for a complete installation.

E. Verify exact mounting height with drawings.

F. Finish: Ivory.

## 2.07 SAFETY DISCONNECTS

A. Toggle Type Disconnect Switches: 120 volt, 1 pole, 20 amp, 1 HP maximum. NEMA 1 enclosure for indoors, NEMA 3R enclosure for outdoors.

B. Manual Motor Starters: Quick-make, quick-break. Thermal overload protection. Device labeled with maximum voltage, current and horsepower. Eaton Electrical, General Electric, Siemens, Square D Class 2510, or approved. Provide NEMA 1 enclosure for indoors, NEMA 3R enclosure for outdoors.

C. Safety Switches: Heavy duty, fused type, dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted. Provide NEMA 1 enclosure for indoors, NEMA 3R enclosure for outdoors. Switches clearly marked for maximum voltage, current and horsepower. Equip enclosure with defeatable cover interlock. Switches rated for maximum available fault current. Manufacturers: Eaton Electrical, General Electric, Siemens, Square D, or approved.

## 2.08 ELECTRICAL IDENTIFICATION

A. Engraved Labels: Melamine plastic laminate, white with black core, 1/16 inch thick, manufactured by Lamicoid. Engravers standard letter style, minimum 3/16-inch high letters, capitals. Drill or punch labels for mechanical fastening except where adhesive mounting is necessary because of substrate. Use self-tapping stainless steel screws.

B. Conductor Numbers: Manufacturers standard vinyl-cloth self-adhesive cable and conductor markers of the wraparound type. Preprinted black numbers on yellow field. Brady, Panduit, or approved.

C. Circuit Breaker Identification: Provide permanent identification number in or on panelboard or motor control center dead-front adjacent to each circuit breaker pole position.

# PART 3 - EXECUTION

## 3.01 ELECTRICAL CHARACTERISTICS

A. Verify electrical characteristics of equipment prior to installation of conduits and wiring for equipment. Coordinate HVAC voltage requirements with drawings and equipment submittals prior to rough in.

## 3.02 MOTOR BRANCH CIRCUIT WIRING

A. Do not install electrical equipment or wiring on mechanical equipment without approval of Architect.

B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.

C. Connect motor branch circuits complete from panel to motor as required by code and manner herein described.

D. Motor starter, control devices and control wiring provided by other Divisions unless noted on drawings.

## 3.03 APPLIANCE/UTILIZATION EQUIPMENT

A. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering devices and coverplates.

## 3.04 INSTALLATION

A. Conduit:
   1. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal PVC conduit joints with solvent cement and metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal).
   2. Conduit Placement:
      a. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.
      b. Conceal conduits. Exposed conduits are permitted only in the following areas:
         1) Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished materials.
         2) Existing walls that are concrete or block construction.
         3) Where specifically noted on the drawings.
      c. Where exposed conduits are permitted install parallel or at right angles to building lines, tight to finished surfaces and neatly offset into boxes.
      d. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block the area passage's intended usage.
      e. Do not install conduits on surface of building exterior, across roof, on top of parapet walls, or across floors.
      f. Route raceway at least 6 inches from hot surfaces above 120F, including noninsulated steam lines, heat ducts, and the like.
   3. Maximum Bends: Install code sized pull boxes to limit sum of bends in a run of conduit to 270 degrees.
   4. Flexible Conduit: Install 12-inch minimum slack loop on flexible metallic conduit and PVC coated flexible metallic conduit.
   5. Conduit Size: Size as indicated on drawings. Where size is not indicated, provide conduit in minimum code permitted size for THW conductors of quantity required for complete operation. Minimum trade size 1/2 inch.

6. Provide pull cord in empty conduits that exceed 10 feet in length or the total sum of bends exceed 90 degree radius.
7. Conduit Use Locations:
   a. Underground: PVC.
   b. Wet Locations, and areas subject to Mechanical Damage: GRC.
   c. Damp Locations and Locations Exposed to Rain: GRC and EMT up to 2 inches in diameter.
   d. Dry, Protected: GRC and EMT.
   e. Sharp Bends and Elbows: GRC, EMT use factory elbows.
   f. Install pull wire or nylon cord in empty raceways provided for other systems. Secure wire or cord at each end.
   g. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.
   h. Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.
   i. Motors and equipment connections subject to movement or vibration and subjected to any of the following conditions; exterior location, moist or humid atmosphere, water spray, oil or grease use PVC coated liquid tight flexible metallic conduit.
8. Branch Circuits: Do not change the intent of the branch circuits or controls without approval. Homeruns for 20 amp branch circuits may be combined to a maximum of six current carrying conductors in a homerun. Apply derating factors as required by CEC. Increase conductor size as needed.
9. Feeders: Do not combine or change feeder runs.
10. Unless otherwise indicated, provide raceway systems for lighting, power and Class 1 remote-control and signaling circuits and Class 2 and 3 remote-control signaling and communication circuits.

B. Conduit Fittings:
1. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2 inches in diameter.
2. Use threaded type fittings in wet locations, and damp or rain-exposed locations where conduit size is greater than two inches.
3. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes and the like that have feeders 60 amperes and greater.
4. Provide bushing or EMT connector for conduits that do not terminate in box, enclosure, or the like.
5. Provide conduit expansion fittings at building expansion joints and at locations where conduit is exposed to thermal expansion and contraction.
6. Condulets and Conduit Bodies: Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger.

C. Sleeves and Chases: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceiling or walls. Maintain integrity of fire-rated assemblies at penetrations of walls, ceilings or floors.

D. Conductors, Wires and Cables:
1. Conductor Installation: Install conductors in raceways having adequate, code size cross-sectional area for wires indicated. Install conductors with care to avoid damage to insulation. Do not apply greater tension on conductors than recommended by manufacturer during installation. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
2. Conductor Size and Quantity: Install no conductors smaller than 12AWG unless

otherwise shown. Provide required conductors for a fully operable system.

3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
   a. Isolated ground circuits.
   b. Ground fault protected circuits where a GFCI breaker is used in a panelboard.
   c. Other electronic equipment that produces a high level of harmonic distortion including, but not limited to, computers, printers, plotters, copy machines, and fax machines.

E. Connectors: Retighten lugs and connectors for conductors to equipment prior to Substantial Completion.

F. Boxes:
1. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
2. Round Boxes: Avoid using round boxes where conduit must enter through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
3. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
4. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.
5. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.
6. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, and other necessary components.
7. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC, except as noted otherwise.
8. Flush Outlets in Finished Spaces: Maintain integrity of insulation and vapor barrier. Surface outlets are only acceptable in areas with surface conduit.
9. Mount center of outlet boxes as required by ADA, or noted on drawings, the following distance above the floor:
   a. Control Switches: 48 inches.
   b. Receptacles: 18 inches.
   c. Telecom Outlets: 18 inches.
   d. Other Outlets: As indicated in other Sections of Specifications or as detailed on drawings.
10. Coordinate electrical device locations (switches, receptacles, and the like) with drawings to prevent mounting devices in mirrors, back splashes, behind cabinets, and the like.

G. Wiring Devices:
1. Wall-Mounted Receptacles: Install with long dimension oriented vertically at centerline height shown on drawings or specified herein.
2. Vertical Alignment: When more than one outlet is shown on drawings in close proximity to each other, but at different elevations, align the outlets on a common vertical center line for best appearance. Verify with Architect.
3. GFCI Outlets: One GFCI receptacle may be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit provided the following conditions are met:
   a. The downstream receptacles are in the same room as the upstream GFCI duplex receptacles, and
   b. The downstream duplex receptacles are labeled as being protected by an upstream GFCI receptacle in the same room.

H. Provide CEC-required disconnect switches whether specifically shown on drawings or not. Provide disconnect switch in sight of each motor location unless otherwise noted. Provide disconnect switch in site of each motor controller. Motor controller disconnect equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Coordinate fuse ampere rating with installed equipment. Fuse ampere rating variance between original design information and installed equipment, size in accordance with Bussmann Fusetron 40C recommendations. Do not provide fuses of lower ampere rating than motor starter thermal units.

I. Supporting Devices:
1. Verify mounting height of luminaires or items prior to installation when heights are not detailed.
2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.
3. Do not use other trade's fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
4. Support conduits within 18 inches of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8 foot spacing.
5. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
6. Provide seismic bracing per CBC requirements for this building location.

J. Electrical Identification:
1. Graphics: Coordinate names, abbreviations and designations used on drawings with equipment labels.
2. Conductor Identification: Apply markers on each conductor for power, control, signaling and communications circuits.
3. Install an engraved label on each major unit of electrical equipment indicating both equipment name and circuit serving equipment (e.g. "EF-1, CKT. 2P1-1,3,5), including but not limited to the following items: Disconnect switches, relays, contactors, time switches, override switches, service disconnects, distribution switches, branch circuit panelboards, and central or master unit of each electrical system including communication/signal systems.
4. Install engraved labels on the inside of flush panels, visible when door is opened. Install label on outside of surface panel.
5. Install signs at locations detailed or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment.

## 3.05 FIELD QUALITY CONTROL

A. Wiring Device Tests: Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

B. Feeder Tests:
1. Test conductor insulation on feeders of 100 amp and greater for conformity with +1000 volt megohmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.
2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the

approximate length of the feeder, conduit type, and the measured resistance of the megohmeter test. Submit report with operating and maintenance manual.

**END OF SECTION**

# SECTION 26 08 05

# ELECTRICAL ACCEPTANCE TESTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Testing, evaluation and calibration of equipment provided, installed and connected in Division 26.
2. Evaluation of connection and normal operation of utilization equipment, provided in other Divisions, for installation and connection in Division 26.

### 1.2 REFERENCES

A. Acceptance Testing Criteria: Latest edition of Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, published by IETA.

B. Applicable Codes, Standards and References:
1. California Electrical Code (CEC).
2. National Electrical Manufacturer's Association (NEMA).
3. American Society for Testing and Materials (ASTM).
4. Institute of Electrical and Electronic Engineers (IEEE).
5. International Electrical Testing Association (IETA).
6. American National Standards Institute (ANSI).
7. State and local codes and ordinances.
8. Insulated Power Cable Engineers Association (IPCEA).
9. Association of Edison Illuminating Companies (AEIC).
10. OSHA Part 1910; Subpart S, 1910.308.
11. National Fire Protection Association (NFPA).

### 1.3 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Retain the services of a recognized independent testing firm for the purpose of performing inspections and tests as specified herein.
2. Independent test firm providing report direct to Architect.
3. Material, equipment, labor and technical supervision to perform tests and inspections provided by testing firm.
4. It is the intent of these tests to assure that electrical equipment, Contractor or Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
5. Tests and inspections determine suitability for energization.
6. Supply to the independent testing organization complete sets of approved shop drawings, coordination study (provided by Contractor's equipment supplier under Contractor's direction, setting of adjustable devices and other information requested by testing agency).

B. Scope of Testing, Evaluation and Calibration:
1. Distribution transformers.
2. Low voltage circuit breakers (greater than 100 amp).
3. Switchboards.
4. Ground fault protective signaling.
5. Grounding systems.
6. Motor control centers.

## 1.4 SUBMITTALS

A. Test Reports:
   1. Maintain written record of tests.
   2. At completion of project, assemble and certify a final test report. Submit report to Architect prior to final acceptance to include:
      a. Summary of project.
      b. Description of equipment tested.
      c. Visual inspection report.
      d. Description of tests.
      e. Test results.
      f. Conclusions and recommendations.

## 1.5 QUALITY ASSURANCE

A. Qualifications of Testing Firm:
   1. Corporately independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers and installers of equipment or systems evaluated by testing firms.
   2. Independent organization as defined by OSHA Title 29, Part 1936 and IETA.
   3. Regularly engaged in the testing of electrical materials, devices, appliances, electrical installations and systems for the purpose of preventing injury to persons or damage to property and other equipment.
   4. Engaged in testing practices for minimum of 2 years.
   5. Use only full-time technicians, regularly employed by firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and line workers may assist, but may not perform testing or inspection services.
   6. Submit proof of above qualifications with Bid Documents.

B. Certifications:
   1. Comply with OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910 and 1936. Full membership in the IETA constitutes proof of such criteria.
   2. Lead, on site, technical person currently certified by IETA in Electrical Power Distribution System Testing.
   3. Instruments used by testing firm to evaluate electrical performance meet IETA Specifications for Test Instruments.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.1 FIELD QUALITY CONTROL

A. Tests:
   1. Contractor's Responsibilities:
      a. Perform routine insulation resistance, continuity and rotation tests for distribution and utilization equipment prior to and in addition to tests performed by testing firm.
      b. Notify the testing firm when equipment becomes available for acceptance tests. Coordinate work to expedite project scheduling.
   2. Testing Firm's Responsibilities:
      a. Notify Architect prior to commencement of any testing.

b. Report directly to Architect any systems, material or installation found defective on the basis of acceptance tests.
c. Provide auxiliary portable power supply necessary for conducting tests.

## 3.2 ADJUSTING

A. Final Settings: Testing firm responsible for implementing final settings and adjustments on protective devices and tap changes in accordance with Architect's specified values.

**END OF SECTION**

# SECTION 26 09 15

# LIGHTING RELAY CONTROL PANEL

## PART 1 - GENERAL

### 1.1 INTRODUCTION

A. The work covered in this Section is subject to requirements in the General Conditions of the Specifications.

B. Coordinate the work in this Section with the trades covered in the other Sections of the Specification to provide a complete and operative system.

### 1.2 DESCRIPTION OF WORK

A. Extent of lighting control system work is indicated by drawings, and by the requirements of this section. It is defined to include lighting relay control panels, switch inputs, intertie to other building systems (fire alarm, security and energy management system for HVAC) and wiring.

B. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring.

C. Basis of Design: Lighting relay panels on Drawings are designed based on PCI Lighting Litekeeper product line. Approved manufacturers listed below are allowed on condition of meeting the specified conditions including the available space for the equipment (including Code required working clearances). Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.

### 1.3 QUALITY ASSURANCE

A. Approvals:
   1. Test the control panels and list under the UL 916 Energy Management Equipment standards.
   2. CEC Compliance: Comply with applicable CEC regarding electrical wiring standards.
   3. NEMA Compliance: Comply with applicable portions of the NEMA standards regarding the types of electrical equipment enclosures.
   4. Component Pretesting: Control equipment shall undergo strict inspection standards. Previously test the equipment and burn-in at the factory prior to installation.

### 1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data on lighting control system and components, including recommended spare parts list.

B. Shop Drawings: Submit drawings of lighting control panel and accessories including, but not necessarily limited to the riser diagram / system diagram, low voltage relay panels, power and communications wiring and termination, input/output schedules and sequence of operation for each control zone.

## 1.5 APPROVED MANUFACTURERS

A. Approved Manufacturers: PCI LiteKeeper 8, Leviton Lighting Controls, Douglas Lighting Controls, Intelligent Lighting Controls, Lighting Control & Design.

## 1.6 WARRANTY

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. Warranty: Manufacturer shall supply a 3-year warranty on all hardware and software. Systems that provided special warranties based on installation shall not be acceptable.

# PART 2 - PRODUCTS

## 2.1 MATERIALS AND COMPONENTS

A. System Description:
1. The lighting control system consists of low voltage relay control panels with 64 programmable switch inputs and up to 8 relays.
2. Each low voltage lighting control panel is microprocessor controlled. Accomplish programming through either the RS-232 port or through the network connection employing the Keeper Enterprise software or with an integral 2 x 16 – 32 character self-prompting LCD display and programming keypad.
3. Programmable intelligence includes time-of-day control, 32 holiday dates, a Warn Off to warn occupants of an impending OFF, timed inputs, preset control, auto daylight savings, astronomical clock w/offsets, and local control, digital switches and network overrides.
4. When control panel provides a Warn Off (flash the lights) to inform the occupants of an impending OFF command. The Warn Off command will allow 10 extra minutes for the occupants to override their lights or exit the premises.
5. Control panels permits lighting to be overridden ON for after-hours use or cleaning. Provide these overrides with hard-wired inputs or voice-guided touch-tone telephone control.
6. Control panel enclosures offer a maximum space of 8 relays.

## 2.2 HARDWARE FEATURES

A. Diagnostic Aids:
1. Each control panel shall incorporate diagnostic aids for confirmation of proper operation, or in case of failure these aids shall guide the individual in rapid troubleshooting of the system.
2. The control panels shall employ both a backlit LCD and LED's to indicate:
   a. POWER (LED).
   b. SYSTEM OK (LED).
   c. ON/OFF STATUS of EACH RELAY (LED & LCD).
   d. SYSTEM CLOCK AND DATE (LCD).
   e. PROGRAMMING CONFIRMATION (LCD).
3. Control systems that do not provide visual self-help diagnostics shall not be acceptable.

B. Status Indication of Relays: The system shall provide visible status indication of all relays through the window of each control panel. The visual indication shall disclose On/Off status and relay number. Systems that do not provide relay status while the enclosure door is closed shall not be acceptable.

C. Operator Interface: The control panel programming interface resides in firmware in the

control panel. The programming interface shall consist of a circuit board mounted keypad and 2 line x 16 character LCD display. The integral keypad shall provide access to the main programming features. The keypad shall permit the user to manually command any or all relays individually. It shall also allow the user to link switch inputs and time schedules to relay outputs. Each panel shall control its own loads from internal memory. A control system that relies on a central control computer/processor or external time clocks shall not be permitted. Systems that utilize blocking diode technology for relay assignments shall not be acceptable.

D. Low voltage switches (Overrides): The controller shall provide timers for each low voltage switch (override). Each low voltage switch (override) timer shall be capable of 0-999 minutes. Software shall enable or disable low voltage switches (overrides) based on Priorities, Masks or Time of Day scheduling.

E. Digital Switch: The lighting controller shall support digitally addressable LED annunciated switches. The maximum total number of digital switches that may exist on the lighting control network is 16,320. Each Subnet shall support 64 buttons. The digital switch network requires CAT 5 cable between switches. The digital switches shall control any relay group combination on the PCI-Net lighting control network. Data communications status feedback for system checkout and troubleshooting (transmit and receive LED'S) shall be visible on the interface. The digital switch configuration system shall permit custom labeling for multiple button switch locations. The digital switch configuration shall be Decora® form and function.

F. Dry Contact Inputs: The control system shall permit 8 dry contacts inputs for override purposes. Support momentary 3 wire or 2 wire (toggle) inputs. Support maintained contacts as 2 wire (SPST) inputs. Inputs shall be dry contacts (24VDC at 12 ma. internally supplied to the inputs). The 24VDC power supply is provided with an auto-resettable fuse. Should an inappropriate electrical connection be made the design shall protect the board and switches until the fault is removed. Software link switch input to any number of relays for override control. The control panel shall have dry contact inputs on the logic board. Control systems that utilize separate accessories to allow for dry contact switches shall not be acceptable. Control systems that do not supply both digital switches and analog switches from the same controller shall not be permitted.

G. Photocell Control: The controller shall accept dry contact ambient light sensors. The controller shall provide power for the sensor thereby eliminating any external power supply. Sensors shall provide for outdoor and indoor applications and issue a command to the controller once the threshold is reached. The sensor shall provide user adjustable dead band control.

H. Remote Overrides: The controller shall accept remote commands issued from other inputs. The controller shall provide this feature without the need to add extra equipment to the controller. Remote overrides can be issued from the Telephone Interface Module (TIM), Photocells, Motion Sensors, Digital or Dry Contact Switches. Lighting systems that need to add extra equipment to receive remote overrides are not acceptable.

I. Service Override & Priority Override: The control panel shall provide a three position master-service override for the control unit. The service override shall not be accessible from the exterior. Systems that provide a service override on the exterior of the controller shall not be acceptable.

J. Modular Design:

1. The control system shall employ all modular connectors to avoid repeat wiring in case of component failure. Mount the system CPU board on quick-release spring pins that shall permit an entire change out of the processor and input board.

2. Connections for the switch inputs shall incorporate modular connectors. Provide modular relay board designed for rapid field replacement or upgrading. Systems that do not employ modular connectors shall not be acceptable.

K. Battery Back-up: The system shall utilize a memory back-up device that is system integrated and non-serviceable. Protect the data in RAM against power interruptions lasting as long as 10 years. Provide maintenance free power interrupt protection circuit.

L. Multi-tapped Transformer: The control panel incorporates the use of a multi-tapped transformer. The panel shall not require specification of voltage for each control location. The voltages of 120 and 277VAC available with each standard control panel.

M. Status Indication of Relays: The system shall provide visible status indication of all relays through the window of each control panel. The visual indication shall disclose ON/OFF status and relay number.

N. Service Override: The control panel shall provide a 3 position service override for the entire panel. The service override shall not be accessible from the exterior.

O. Lockable Enclosure: Enclose each control panel in a lockable NEMA Class 1 enclosure and shall provide pre-punched knockouts.

P. Relays: Electrically held 20amp 120/277VAC relays. Relays must be specified Normally Open or Normally Closed. Rate the relays for 10 million mechanical operations.

1. Standard Relay Module (SRM-NC): The system shall utilize normally closed control relays, which are rated to 20 amps at 120/277VAC. Magnetically hold the relays and provide on a card of eight relays per card. The wire terminations shall be able to accept 10 AWG. Rate the relays for 10 million mechanical operations. Provide a limited 10-year warranty on the individual relay cards. Systems that do not offer a limited 10-year warranty on all installations are not acceptable.
2. Latching Relay Card (LRC): The controller shall provide an option to provide latching relays that are rated to 20 amps at 347VAC. The relay shall provide an integral switch for both manual hand operation and visual indication of relay status. Rate the relays for 10 million mechanical operations. The wire terminations shall be able to accept 6 AWG wire. Provide a limited 10-year warranty on the individual relays. Systems that do not offer a limited 10-year warranty on all installations are not acceptable.
3. Latching Relay Card (LRC-RR7): The controller shall provide an option for remote placement of the control relays. A modular card shall connect into the relay compartment. Twisted (3) conductor cable shall power and control the remote mounted relays. Maximum distance is 500 feet employing 18 AWG conductor.
4. The following features shall be standard in the PC based software:
   a. Standard Software Features:
      1) Real Time Relay Status Monitoring.
      2) Alpha-Numeric Descriptors.
      3) Communications: Direct, TCP/IP and Modem.
      4) Status Indication.
      5) Global Software Modifications.
      6) Manual Relay Commands.
      7) Relay Pattern Commands.
      8) Preset Options.
      9) User Management – Password protection and privilege modification for multi-user security.
      10) Logging of Controller Actions (switch inputs, TIM commands, & relay actuations).
   b. File Maintenance:

1) Archive Programs.
2) Data Base Restoration.
3) Uploading and Downloading of Programs.
4) Snap Shots — indication of changes and flawless panel restoration.

c. Software package shall permit the PC to be utilized for other functions (i.e. word processing, database, & etc.) besides lighting control. Systems that require an "on-line" dedicated computer for control system operation shall not be acceptable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION AND DOCUMENTATION

A. Installation: Install the control system and fully wire as shown on the drawings by the installing contractor. Complete all electrical connections to all control circuits, and override wiring.

B. Documentation: Provide accurate "as-built" drawings to the owner for correct programming and proper maintenance of the control system. The "as-builts" shall indicate the load controlled by each relay and the relay panel number.

C. Operation and Service Manuals: The factory shall supply all operation and service manuals.

### 3.2 PRODUCT SUPPORT AND SERVICE

A. Factory Support: Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

### 3.3 SYSTEM ACCEPTANCE

A. Test to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved drawings and specifications.

B. Functionally test sequences of operation to ensure operation in accordance with approved drawings and specifications.

C. Prepare and complete report of test procedures and results and file with the Owner.

D. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.

E. Demonstration of program integrity during normal operation and pursuant to a power outage.

F. Provide a minimum of 4 hours training on the operation and use of the control system.

G. Lighting System Control Testing and Commissioning:
1. Test lighting controls to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with Drawings and Specifications. Provide functional testing of sequences of operation to ensure operation in accordance with Drawings and Specifications. Provide complete report of test procedures and results to engineer and insert approved copy into

project closeout documents.

2. Testing shall include:
   a. Occupant sensing automatic controls.
   b. Automatic time and override controls for interior lighting.
   c. Automatic time and photo controls for exterior lighting.

**END OF SECTION**

# SECTION 26 09 21

# OCCUPANCY SENSORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Occupancy sensors.
2. Combined occupancy sensor/wall switches ("sensor/switches").
3. Automatic switches.

### 1.2 SYSTEM DESCRIPTION

A. Provide occupancy sensors to sense the presence of human activity within the desired space and enable or disable the on/off manual lighting control function provided by local switches.

B. Upon detection of human activity by the detector, sensor initiates a time delay to maintain the lights on for a preset period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.

C. Factory set sensors for maximum sensitivity.

D. LED lamp built into sensor indicates when occupant is detected.

E. Provide zero cross relay control with sensors and sensor/switches; relay contacts close and open when AC voltage signal is at zero.

F. Where line voltage sensors and sensor/switches are used, provide to match voltage of controlled circuit.

G. Line Voltage Sensors, Control Units, and Relays: UL listed.

### 1.3 SUBMITTALS

A. Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.

B. Provide wiring diagrams indicating low voltage and line voltage wiring requirements.

## PART 2 - PRODUCTS

### 2.1 OCCUPANCY SENSORS (CEILING MOUNTED)

A. Passive Infrared Sensors:
1. Sensor Function: Detects human presence in the floor area being controlled by detecting changes in the Infrared energy. Sensor detects small movements, i.e., when a person is writing while seated at a desk.
2. Provide a temperature compensated dual element pyro-electric sensor and with multielement Fresnel lens.

3. Sensor utilizes DIP switches for adjustment to time delay and override. Field adjustable settings for sensitivity.
4. Provide a daylight filter to ensure that the sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by the sun.
5. Conceal adjustments and mounting hardware under a removable cover to prevent tampering with adjustments and hardware.
6. Sensor utilizes advanced digital signal processing technology to reduce false offs without reducing sensitivity.
7. Ceiling-Mounted Sensor:
   a. 360 degree sensor range; coverage: 1200 square feet, unless otherwise noted on Drawings.
   b. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel allow coverage of large areas.
   c. Manufacturers: Watt Stopper CI-300 Series, or approved.

B. Ultrasonic Occupancy Sensors:
1. Sensor Function: Detects human presence in the controlled floor area by detecting Doppler shifts in 40kHz ultrasound created by sensor.
2. Sensors are precision crystal controlled and do not interfere with each other when two or more are placed in the same area. Sensor includes advanced digital signal processing to reduce false on signals without decreasing sensitivity, as well as immunity to RFI/EMI sources.
3. Depluggable terminal for plug-and-play replacement.
4. Sensor utilizes DIP switches for adjustment to time delay and override. Field adjustable settings for sensitivity.
5. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel allow coverage of large areas.
6. Ceiling-Mounted Sensor:
   a. Maximum protrusion of 1.1 inches and blend in aesthetically with the ceiling.
   b. Coverage: 360 degree sensor range; coverage: 2,000 square feet, unless otherwise noted on Drawings.
   c. Manufacturers: The Watt Stopper UT Series, or approved.
7. Ceiling Mounted Sensor – Hallway Sensor Coverage:
   a. Maximum protrusion of 1.5 inches and blend in aesthetically with the ceiling.
   b. Coverage: 90 lineal feet.
   c. Manufacturers: The Watt Stopper WT-2250 Series, or approved.

C. Dual Technology Sensors:
1. General: Sensor has combined capability of passive infrared and ultrasonic sensors as described above.
2. Function: Upon a person entering a space, motion must be sensed by both technologies before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on for the set time period. Sensor shall have a retrigger time delay where only one motion is necessary to turn on the lights within 5 seconds after turning off.
3. Ceiling-Mounted Sensor:
   a. 360 degree sensor range; coverage: 1000 square feet for half-step motion, unless otherwise noted on Drawings.
   b. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel allow coverage of large areas.
4. Manufacturers: Watt Stopper DT-300 Series, or approved.

## 2.2 COMBINED OCCUPANCY SENSOR/WALL SWITCHES ("SENSOR/SWITCHES")

A. Completely self-contained sensor system that fits into a standard single gang box. Internal transformer power supply, latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.

B. Passive infrared sensor technology includes advanced signal processing to reduce false triggers without increasing sensitivity.

C. Rated to switch loads: 800 watts incandescent or 120-volt ballast; 1000 watts 277 volt ballast.

D. Provide adjustable daylight feature that holds lighting "off" when a desired footcandle level is present.

E. Provide integral off override switch with no leakage current to the load or ground.

F. Provide hard 1mm poly IR2 lens; soft lens is not acceptable.

G. Alerts for impending shut-off: light flash, audible, both or none.

H. Standard Sensor/Switch:
1. 180 degree sensor range; coverage: 150 square feet for desktop activity.
2. Manufacturers: The Watt Stopper WA-200 Series, or approved.

I. Digital Timer Switch:
1. Controls up to 1800 watts at 120 volt, 4100 watts at 277 volt, suitable for ballast and motor loads.
2. Compatible with Decora style faceplate.
3. Provide low voltage (24VAC/VDC) version where used as input to lighting relay panel; includes single-pole, double-throw isolated relay rated for 1A at 30VDC.
4. Electroluminescent LCD display shows timer countdown.
5. Time out setting range from five minutes to 12 hours. Lights can be turned off before the time-out setting by holding down the on/off button.
6. Timer countdown can be reset to beginning by holding down push button for 2 seconds.
7. Zero crossing circuitry.
8. Room lighting flashed and switch beeps 5 minutes and 1 minute prior to switching room lighting off. Either visible or audible features can be disabled.
9. Manufacturers: Wattstopper TS-400 Series, or approved.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install occupancy sensors as directed by manufacturer's instructions. Provide connections to control circuits, occupancy sensors, power supply pack and low voltage wiring.

B. Drawings were laid out using Watt Stopper sensors as the basis of design. If another manufacturer is approved for installation under this Contract, verify with manufacturer representative that sensors are laid out to provide coverage across room space, adding additional sensors as needed.

C. Provide power packs for the sensor to control the number of circuits and/or switch legs within its area of coverage.

D. Field adjust each sensor to maximize its coverage of the room space.

E. Relocate sensors with ultrasonic technology to avoid being closer to HVAC diffusers and power packs than recommended by manufacturer.

F. Field set time delay for each device as noted below:
1. Classrooms and Conference Rooms: 30 minutes.
2. Restrooms: 30 minutes.
3. Storage Rooms, Janitor's Closets, Unisex Restrooms: 5 minutes.
4. All Other Spaces: 15 minutes.
5. Timer Switches: two hours.

## 3.2 QUALITY CONTROL

A. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner.

B. Prepare and complete report of test procedures and results. Submit these test procedures and results to Owner and Architect.

**END OF SECTION**

# SECTION 26 50 00

# LIGHTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Luminaires and lampholders.
2. Ballasts.
3. Lamps.
4. Emergency lighting equipment.

### 1.2 SUBMITTALS

A. Submit for:
1. Luminaires: Include electrical ratings, dimensions, mounting, material, required clearances, terminations, wiring and connection diagrams, photometric data, diffusers, and louvers.
2. Ballasts.
3. Lamps.
4. Emergency lighting equipment.

B. Provide the following operating and maintenance instructions from the manufacturer for project closeout, see Project Closeout Requirements in Division 1:
1. Luminaires.
2. Ballasts.
3. Lamps.
4. Emergency lighting equipment.

### 1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Provide luminaires acceptable to code authority for application and location as indicated.
2. Comply with applicable ANSI standards pertaining to lamp materials, lamp ballasts and transformers, and luminaires.
3. Comply with applicable NEMA standards pertaining to lighting equipment.
4. Provide luminaires and lampholders which comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the AHJ (e.g. UL, ETL, and the like).
5. Comply with CEC as applicable to installation and construction of luminaires.
6. Comply with fallout and retention requirements of CBC for diffusers, baffles, louvers, and the like.

### 1.4 WARRANTY

A. Ballast Manufacturer's Warranty: Not less than 2 years for magnetic type ballasts and 5 years for electronic type ballasts, based on date of manufacturer embossed on ballast, current with installation date. Warranty includes normal cost of labor for replacement of ballast.

B. Lamp Warranty: 6 months for compact fluorescent, 12 months for fluorescent and HID lamps.

### 1.5 MAINTENANCE

A. Furnish two percent extra lens or louvers for each size and type of fluorescent luminaire.

B. Furnish 10 percent extra lamps for each size and type installed.

C. Furnish 5 percent extra ballasts for each size and type.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRES

A. Luminaires: Refer to description and manufacturers in Luminaire schedule.

B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.

C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet locations.

D. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material.

E. Finishes:
1. Manufacturer's standard finish (unless otherwise indicated) over a corrosion resistant primer.
2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectances.
3. Exterior Finishes: As detailed in luminaire schedule or on Drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.

F. Light Transmitting Components:
1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.
2. Prismatic acrylic, extruded, flat diffusers, 0.125 inch overall thickness, unless otherwise noted.

G. Fluorescent Luminaires:
1. Provide open lamp fluorescent luminaires without diffusers or guards with turret type, spring loaded sockets.
2. To facilitate multilevel lamp switching, wire lamps within luminaire with outermost lamp at both sides of luminaire on the same ballast, the next inward pair on another ballast and so on to innermost lamp (or pair of lamps).
3. For T5HO lamps, provide twist and lock design sockets, socket body rated to 110C and socket rotor rated to 140C.
4. Provide wire lamp guards on exposed lamp fluorescent luminaires.

### 2.2 BALLASTS

A. General:
1. Provide ballasts UL rated for specified lamps.
2. Thermal Protection: Internal UL Class 'P' with automatic reset.

3. Sound Ratings: Class 'A'. Where not available as standard product from any specified manufacturer, provide quietest rating available.
4. Total Harmonic Distortion: Not to exceed 20 percent of the input current unless otherwise indicated.
5. Input Voltage: Provide universal voltage ballast matching branch circuit supply voltage.
6. Provide quantity of ballasts to provide switching as indicated on Drawings.
7. Provide factory printed wiring diagram on ballast housing.
8. Ballasts used in enclosed and gasketed luminaires shall be of Type 1 construction.
9. Comply with FCC rules and regulations Part 18, Class A concerning generation of both electromagnetic interference and radio frequency interference.
10. Provide three year warranty against defects in materials and workmanship, including either a USD 10 replacement labor allowance or complete replacement including labor by an agent of the manufacturer.

B. Ballasts for Linear Fluorescent Lamps:
1. Power Factor: Minimum 97 percent.
2. Do not provide magnetic fluorescent ballasts.
3. Nondimming Electronic:
   a. Tandem wiring between luminaires may be used to minimize the number of ballasts while accomplishing the switching requirements shown on Drawings. Provide label in lamp compartment of luminaire to identify the function of ballast. Label shall not be visible from room.
   b. Provide ballasts that meet requirements of UL 935, ANSI C82.11 and bear the appropriate UL label.
   c. Provide ballasts that withstand input power line transients as defined in ANSI C62.41, Category-A and IEEE 587.
   d. High frequency operation: Not less than 42kHz.
   e. Lamp Crest Factor: Maximum 1.7 for programmed rapid start ballasts and maximum 1.85 or less for instant start ballasts.
   f. Average Ballast Factor (BF): Minimum 88 percent or as indicated in the luminaire schedule.
   g. Provide 0 degree Fahrenheit minimum starting temperature ballasts for luminaires installed where exposed to anticipated ambient temperature less than 55F.
   h. Manufacturers: Advance, Universal Lighting Technologies, OSRAM/Sylvania, or approved.
4. Dimming Electronic:
   a. Meet requirements of nondimming electronic ballasts.
   b. Do not use tandem wiring between luminaires.
   c. Ballast shall start lamp at any preset light output setting and provide continuous, square law dimming from 100 percent to specified low-end output.

C. Ballasts for Compact Fluorescent Lamps:
1. Power Factor: Minimum 97 percent.
2. Provide ballasts which meet requirements of UL 935, ANSI C82.11 and bear the appropriate UL label.
3. With integral end of lamp life detection and shutdown circuit with automatic reset.
4. Nondimming Electronic:
   a. Series wired, programmed rapid start circuitry.
   b. High frequency operation: Not less than 50kHz.
   c. Lamp Crest Factor: Maximum 1.5.
   d. Average Ballast Factor (BF): Minimum 98 percent.
   e. 0 degree Fahrenheit minimum starting temperature.
   f. Manufacturers: Advance, OSRAM/Sylvania, Universal Lighting Technologies, or approved.

D. Provide special types as indicated in the luminaire schedule.

## 2.3 LAMPS

A. Provide lamps for luminaires.

B. Provide lamp cataloged for specified luminaire type.

C. Provide similar lamps by a common manufacturer unless indicated in the luminaire schedule.

D. Manufacturers: General Electric, Philips, OSRAM/Sylvania (OSI), Venture, Ushio (MR only), EYE (MR only), or approved unless specific manufacturer is indicated in the luminaire schedule.

E. Incandescent: Not allowed unless noted in luminaire schedule.

F. Fluorescent:
   1. Provide 3500K fluorescent lamps unless noted in luminaire schedule.
   2. Linear Fluorescent:
      a. T-8: Provide the following:
         1) Bi-pin base, tri-phosphor coated.
         2) CRI equal to or exceeding 85.
         3) 30000 hours rated on three hour switching cycle when used with programmed start ballast.
         4) Compatible with dimming ballasts.
         5) Length and wattage as indicated in the luminaire schedule.
      b. T-5: Provide the following:
         1) bi-pin base, tri-phosphor coated.
         2) CRI equal to or exceeding 85.
         3) Compatible with dimming ballasts.
         4) Length and wattage as indicated in the luminaire schedule.
      c. Do not provide T-12 lamps.
   3. Compact Fluorescent:
      a. Single ended, four-pin plug-in base, tri-phosphor coated, CRI exceeding 81, CCT, wattage and configuration as indicated in the luminaire schedule.
      b. Do not provide self ballasted screw-in type unless indicated in the luminaire schedule.
      c. Do not provide magnetic starter type luminaires, ballasts or lamps.

G. Special types as indicated on the luminaire schedule.

# PART 3 - EXECUTION

## 3.1 COORDINATION

A. Verification of Conditions: Verify ceiling construction, recessing depth and other construction details prior to release of luminaire for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment.

B. Provide lighting indicated on Drawings with a luminaire of the type designated and appropriate for location. Where outlet symbols appear on Drawings without a type designation, provide a luminaire the same as those used in similar or like locations.

C. Provide fluorescent and HID luminaires with ballast compatible to lighting control system

as shown in drawings and specifications.

## 3.2 INSTALLATION

A. Install luminaire of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.

B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.

C. Avoid interference with and provide clearance for equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.

D. Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.

E. Egress Luminaires: Provide unswitched emergency circuit to exit signs and emergency luminaires from central battery inverter.

F. Interior Luminaire Supports:
1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.
2. Maintain luminaire positions after cleaning and relamping.
3. Support luminaires without causing ceiling or partition to deflect.
4. Provide recessed fluorescent luminaires with four supports as required by DSA.

G. Wiring:
1. Recessed luminaires to be installed using flexible metallic conduit with luminaire conductors to branch circuit conductors in a nearby accessible junction box over ceiling. Junction box fastened to a building structural member within 6 feet of luminaire.
2. Install luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.
3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.
4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.
5. Unit Battery Equipment in Egress Luminaires: Provide unswitched conductor to each egress luminaire from serving circuit. This is for the transfer electronics to determine when power has actually been lost.

H. Relamp luminaires which have failed lamps at completion of work.

## 3.3 ADJUSTING

A. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.

B. Align luminaires that are not straight and parallel/perpendicular to structure.

## 3.4 CLEANING

A. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.

B. Where finish of luminaires and poles has been damaged, touch up finish as directed by

manufacturer's instructions.

**END OF SECTION**

# SECTION 27 00 00

# TELECOMMUNICATIONS BASIC REQUIREMENTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes general administrative and procedural requirements for Sections under Division 27, and is intended to supplement, not supersede, Division 1 requirements.

B. The requirements described herein include the following:
1. References.
2. Definitions.
3. Submittals.
4. Quality Assurance.
5. Delivery, Storage And Handling.
6. Scheduling.
7. Warranty.
8. Project Management and Coordination Services.
9. Field quality control.
10. Project Closeout and Record Documents.

C. Related Sections:
1. Consult other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation.
2. General and Supplementary Conditions and general provisions of Contract apply to 27 00 00 series Sections.
3. Division 0 and Division 1 of the Project Manual apply to 27 00 00 series Sections.
4. Section 27 05 28 - Telecommunications Building Pathways.
5. Section 27 08 00 - Telecommunications Testing.
6. Section 27 15 13 - Telecommunications Horizontal Cabling.

### 1.2 REFERENCES

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

B. Codes: Perform Work executed under this Section in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
1. United States Department Of Labor (DOL) Regulations (Standards - 29 CFR) Part 1910, "Occupational Safety and Health Standards".
2. National Fire Protection Agency (NFPA)
   a. NFPA 70, "National Electrical Code" (NEC).
   b. NFPA 75, "Protection Of Information Technology Equipment."

3. California Code of Regulations (CCR) Title 24, California Building Standards Code Part 2, Basic Building Regulations and Part 3, California Electrical Code (CEC).
4. Uniform Building Code (UBC).
5. Uniform Fire Code (UFC).
6. Uniform Mechanical Code (UMC).
7. National, State, Local and any other binding building and fire codes.
8. FCC Regulations:
   a. Part 15 – Radio Frequency Devices & Radiation Limits.
   b. Part 68 – Connection of Terminal Equipment to the Telephone Network.

C. Standards: Equipment and materials furnished under this Section shall conform to the following standards where applicable:
1. Underwriter's Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
   a. UL 444: Communications Cables.
   b. UL 497: Protectors for Paired-Conductor Communication Circuits.
   c. UL 1651: Optical Fiber Cable.
   d. UL 1690: Data-Processing Cable.
   e. UL 1963: Communications-Circuit Accessories.
   f. UL 2024A: Optical Fiber Cable Routing Assemblies.
2. ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard.
   a. Part 1: General Requirements.
   b. Part 2: Balanced Twisted-Pair Cabling Components.
   c. Part 2, Addendum 1: Transmission Performance Specifications For 4-Pair 100 Ohm Category 6 Cabling.
   d. Part 3: Optical Fiber Cabling Components Standard.
3. ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces, including the following addenda:
   a. TIA/EIA-569-A-1 Surface Raceways.
   b. TIA/EIA-569-A-2 Furniture Pathways and Spaces.
   c. TIA/EIA-569-A-3 Access Floors.
   d. TIA/EIA-569-A-4 Poke-Thru Fittings.
   e. TIA/EIA-569-A-6 Multi-Tenant Pathways and Spaces.
   f. TIA/EIA-569-A-7 Cable Trays and Wirelines.
4. ANSI/TIA/EIA-598-B Optical Fiber Cable Color Coding.
5. ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
6. ANSI/J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
7. ANSI/TIA/EIA-758 Customer-Owner Outside Plant Telecommunications Cabling Standard: TIA/EIA-758-1 Addendum No. 1.
8. EIA testing standards.
9. Insulated Cable Engineers Association (ICEA):
   a. ANSI/ICEA S-80-576-2002 Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables for Use in Communications Wiring Systems.
   b. ANSI/ICEA S-83-596-1994 Fiber Optic Premises Distribution Cable.
   c. ANSI/ICEA S-87-640-1999 Fiber Optic Outside Plant Communications Cable.
   d. ANSI/ICEA S-90-661-2002 Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems.
   e. ICEA S-104-696-2001 Standard For Indoor-Outdoor Optical Cable.

10. Building Industry Consulting Services International (BICSI):
    a. Telecommunications Distribution Methods Manual (TDMM).
    b. Customer-Owner Outside Plant Design Manual.
    c. Wireless Design Reference Manual (WDRM).
    d. Network Design Reference Manual (NDRM).

D. Make a copy of each document readily available during the course of construction for reference by field personnel.

## 1.3 DEFINITIONS

A. The Definitions of Division 0 shall apply to the 27 00 00 sections.

B. In addition to those Definitions of Division 0, the following list of terms as used in this Section and Sections 27 00 00 shall be defined as follows:
1. "Connect": To install required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
2. "Cabling": A combination of cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling.
3. "Identifier": A unique code assigned to an element of the telecommunications infrastructure that links it to its corresponding record.
4. "Engineer" and "Engineer Of Record": Interface Engineering Inc.

## 1.4 SYSTEM DESCRIPTION

A. In circumstances where the Specifications and Drawings conflict, the most stringent requirement shall apply. Generally, the Drawings shall govern quantity and the Specifications shall govern quality.

**1.5 SUBMITTALS** Submit required submittals in accordance with Section 01 25 00.

B. Obtain approval in writing by the Engineer for the Product Data submittals and for the Shop Drawings (as required) prior to release of order for products and equipment, and prior to installation.

C. Product Data Submittal Requirements
1. Quantity: Submit quantity of product data submittals as described in Section 01 25 00. In the absence of requirements given, submit nine product data submittals.
2. Format:
    a. Product data sheets shall be 8-1/2 x 11 inch pages or 11x17 for oversized information.
    b. Package each submittal with an outer cover. Examples include:
        1) 3-ring binder with front cover and spine having clear pockets for insertion of the submittal information.
        2) 3-hole report cover with transparent front cover. Clearly label each submittal on the outer cover with the following information:
        3) Project name and address.
        4) Submittal Title (e.g., "Product Data Submittal For Telecommunications Equipment Rooms").
        5) Project submittal number.
        6) Specification section number/s (e.g., "Section 27 11 00").
        7) Date and revision; date format: <month> <day>, <year> (e.g., "January 1, 2000").

8) General Contractor / Prime Builder.

9) Telecommunications Installer.

c. Include index dividers for improved navigation through the submittal. Dividers shall match the Table Of Contents.

3. Content:

a. Table Of Contents: Include a Table Of Contents at the beginning of submittal that lists materials by article and paragraph number (e.g., "2.02-A Equipment Racks").

b. Cover Letter: Include a cover letter that states the scope of the submittal and states the submittal is in full compliance with the requirements of the Contract Documents, with a specific reference that the submittal complies with Section 01 25 00 procedures. The cover letter shall be signed (and stamped, if applicable) by the person who prepared the submittal. Failure to comply with this requirement shall constitute grounds for rejection of submittal.

c. Product Information: Product Data submittal shall consist of manufacturer's technical data, product literature, "catalog cuts", data sheets, specifications, and block wiring diagrams (if necessary). Also include applicable Materials Safety Data Sheet (MSDS) for each item complying with OSHA's Hazard Communication Standard 29 CFR 1910.1200. This data shall clearly describe the product's characteristics, physical and dimensional information, electrical performance data, materials used in fabrication, material color & finish, and other relevant information such as test data, typical usage examples, independent test agency information, and storage requirements. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories, which are included and those which are excluded. At a minimum, include products listed in the specifications numbering 27 00 00. Also include relevant products that will be installed, which are not listed in the specifications.

d. Seismic Calculations: Where required, include in the product data submittal the manufacturer's anchorage calculations for floor-mounted, fully loaded equipment racks/frames/cabinets such that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of 1.25. Specify proof loads for drilled-in anchors, if used. A Structural Engineer currently registered in the State of California shall prepare calculations and shall wet stamp and sign them. Forward calculations to the Owner for review and approval.

e. Resubmittals: Resubmittals shall include a cover letter that lists the action taken and revisions made to each product submittal in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

D. Shop Drawings Submittal Requirements:

1. Quantity: Submit quantity of shop drawings as described in Section 01 25 00. In the absence of requirements given, submit six sets of shop drawings.

2. Media: Submit shop drawings on media as described in Section 01 25 00. In the absence of requirements given, submit shop drawings full size on bond or eco-bond.

3. Format:

a. Prepare shop drawings using AutoCAD 2000 or later.

b. Full size shall equal the Contract Documents.

c. Use the project title block. Insert company information in title block.

d. Text shall be 3/32" high, minimum, when plotted full size.

e. Device symbols shall match those used in the Contract Drawings.
f. Screen background information.
g. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.
h. Label each sheet in the shop drawings set with the Specification Section Number (e.g., "27 13 10").
i. Scaling:
   1) Scale floor plans and reflected ceiling plans at 1/8"=1'-0".
   2) Scale enlarged room plans at 1/4"=1'-0".
   3) Scale wall elevations at 1/2"=1'-0".
   4) Scale rack elevations at 1"=1'-0".

4. Content:
   a. Submit detailed shop drawings if the proposed installation differs from the Contract Documents or the design intent.
   b. Cover Letter: Accompany each shop drawing submittal with a cover letter stating that the shop drawings have been thoroughly reviewed by the Contractor and are in full compliance with the requirements of the Contract Documents. Cover letters shall include a drawing index, and shall be signed (and stamped, if applicable) by the person who prepared the submittal. Failure to comply with this requirement shall constitute grounds for rejection of submittal.
   c. Drawings: Shop drawing submittals shall consist of floor plans, reflected ceiling plans, enlarged room plans, wall and rack elevations, installation details, and any other aspect of the system that differs from the Contract Documents or the design intent. Scales shall be the same as the Drawings (e.g., 1/4" = 1'-0" for enlarged room plans).
   d. Seismic Calculations: As part of the shop drawings submittal, the manufacturer shall provide anchorage calculations for floor mounted fully loaded distribution frames such that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of 1.25. Specify proof loads for drilled-in anchors, if used. A Structural Engineer registered in the State of California shall prepare Structural Calculations, and shall wet stamp and sign them. Forward calculations to the Owner for review and approval.
   e. Resubmittals: Accompany resubmittals with a cover letter that lists the revisions made to each drawing in response to Submittal Review Comments. Resubmittals will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

E. As-Built Drawings Submittal Requirements:
1. Quantity: Submit quantity of as-built drawings as described in Section 01 25 00. In the absence of requirements given, submit six sets of as-built drawings.
2. Media: Submit shop drawings on media as described in Section 01 25 00. In the absence of requirements given, submit shop drawings full size on bond or eco-bond.
3. Format:
   a. Prepare as-built drawings using AutoCAD 2000 or later.
   b. Use the same sheet size as the Contract Documents, and use the project title block.
   c. Text: minimum of 3/32" high when plotted at full size.
   d. Use symbols identical to the symbols shown on the Drawings.
   e. Screen background information.
   f. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.

4. Content:
   a. As-Built Drawings shall fully represent actual installed conditions and shall incorporate revisions made during the course of construction.
   b. Floor plans shall show:
5. Locations and identifiers of outlets/devices.
6. Size, quantity, location, and routes of pathways (such as cable basket, conduits, cable hangers, and other cable support devices). Enlarged room floor plans scaled at 1/2"=1'-0" showing exact placement of equipment cabinets/frames, rack bays, and other equipment. Enlarged room overhead plans scaled at 1/2"=1'-0" showing exact placement of overhead cable support devices (e.g., cable basket, cable runway, conduit sleeves, etc.).
7. Applicable rooms: Telecommunications Room
   a. Wall elevations scaled at 1"=1'-0" showing exact placement of termination hardware (e.g., termination/cross-connect blocks).
   b. Installation details.

F. Operation and Maintenance (O & M) Manuals Submittal Requirements:
1. Quantity: Submit quantity of O&M Manuals as described in Section 01 25 00. In the absence of requirements given, submit six product data submittals.
2. Format:
   a. Package each O & M Manual in a white, 3-ring binder with front cover and spine having clear pockets for insertion of the project information.
   b. Clearly label the cover of each O & M Manual with the following information:
      1) Client name.
      2) Project name and address.
      3) Manual title (e.g., "Operation And Maintenance Manual for Telecommunications Cabling System").
      4) Date; date format: <month> <day>, <year> (e.g., "January 1, 2000").
      5) Telecommunications Installer and General Contractor names. Include tabbed separators for improved navigation through the manual.
3. Content:
   a. Include a Table Of Contents at the beginning that lists the contents.
   b. 11"x17" prints of As-Built Drawings, as described above.
   c. One CD-ROM of AutoCAD files of as-built drawings.
   d. Manufacturer's original catalog information sheets for each component provided under applicable Section.
   e. Warranty certificate from the manufacturer and the Contractor.
   f. Manufacturer's instructions for system or component use.
   g. Instructions for maintenance and warranty issues.

## 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications
1. Five continuous years, minimum, design and manufacture of the materials and equipment specified herein.
2. Manufacturer(s) of all products and equipment specified herein shall demonstrate that they have a quality assurance program in place to assure that all of the specifications are met. The program shall include, as a minimum, provisions for:
   a. Incoming inspection of raw materials.
   b. In-process inspection and final inspection of the cable product.
   c. Calibration procedures of all test equipment to be used in the qualifications of the product.
   d. Recall procedures in the event that out of calibration equipment is identified.
3. Conformance to certain government standards on quality assurance may be

required for some applications within these specifications.

B. Contractor Qualifications:
1. Current, active, and valid C7 or C10 California State Contractors License. Provide a copy of Contractors License in the bid submission.
2. Five, minimum, continuous years experience.
3. Five, minimum, completed projects similar to scope and cost. Provide a list of projects, including references, in the bid submission.
4. Technicians qualified for the work. Provide evidence in the bid submission of Technician qualifications. Evidence shall consist of manufacturer certifications, manufacturer training, industry training, relevant project experience, etc.
5. Also refer to additional requirements stated in Sections 27 05 26 through 27 15 13.

C. Materials:
1. Materials and equipment furnished shall be new, unused and without defects.
2. Furnish only specified products and equipment, or products and equipment that have been approved in writing.

D. Regulatory Requirements:
1. Work and materials shall conform to the latest rules of National Board of Fire Underwriters wherever such standards have been established and shall conform to the regulations of the State Fire Marshal, OSHA and the codes of the governing local municipalities. Nothing in these specifications is to be construed to permit work not conforming to the most stringent of the applicable codes.
2. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.
3. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this series of Sections, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Drawings and Specifications. The Contract Documents address the minimum requirements for construction.

E. Project Management And Coordination Services:
1. Provide a project manager for the duration of the project to coordinate this Work with other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.
2. Review of Shop Drawings Prepared by Other Subcontractors:
   a. Obtain copies of shop drawings for equipment provided by others that require telecommunication service connections or interface with Division 26 work.
   b. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 26 contract documents. Document any discrepancy or deviation as follows:
      1) Prepare memo summarizing the discrepancy.
      2) Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.
      3) Prepare and maintain a shop drawing review log indicating the following information:
      4) Shop drawing number and brief description of the system/material.
      5) Date of your review.
      6) Indication if follow-up coordination is required.

F. Drawings:
1. Layout: Follow the general layout shown on the Drawings except where other work may conflict with the Drawings.
2. Accuracy: Drawings for the Work within this Division are essentially diagrammatic within the constraints of the symbology applied.
3. The Drawings do not fully represent the entire installation for the Telecommunications Cabling System. Drawings indicate the general route for the cables and the location of outlets.
4. Complete the details necessary for point-to-point design. This allows the Contractor to achieve desired results applying their own procedures and methods. Submit shop drawings for review prior to installation.

G. Role of the Engineer:
1. During construction, the Engineer will work with the Contractor to provide interpretation and clarification of project contract documents, reply to (and 'process') relevant Requests for Information (RFIs), and act as an interface between the Contractor and the Owner.
2. The Owner has retained the Engineer's services to observe the Work for general compliance with the Contract Documents and to ensure that the installation meets the design intent of the system.
3. In summary, the Engineer will perform the following specific services during the construction phase:
   a. Review product submittals and shop drawings (as required) for general compliance with the contract drawings and specifications.
   b. Review changes as they arise, and confirm that the proposed solutions maintain the intended functionality of the system.
   c. Observe progress of the construction, and report observations back to the Owner.
   d. Review the testing procedures to confirm compliance with project requirements and industry-accepted practices.

## 1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Products shall not be delivered to the site until protected storage space is available.
2. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at jobsite.
3. Deliver materials in manufacturer's original, unopened, undamaged packaging and containers with identification labels (name of the manufacturer, product name and number, type, grade, UL classification, etc.) intact.
4. Replace equipment damaged during shipping at no cost to the Owner.

B. Storage and Protection:
1. Store materials in clean, dry, ventilated space free from temperature and humidity conditions (as recommended by manufacturer) and protected from exposure to harmful weather conditions.
2. Comply with manufacturer's requirements for each product. Comply with recommended procedures, precautions or remedies as described in the Material Safety Data Sheets (MSDS) as applicable.
3. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
4. Storage outdoors covered by rainproof material is not acceptable.
5. Provide heat where required to prevent condensation or temperature related damage.

C. Handling:
1. Handle in accordance with manufacturer's written instructions.

2. Damaged equipment shall not be installed.
3. Replace damaged equipment at no cost to the Owner.
4. Handle with care to prevent internal component damage, breakage, denting, and scoring.

## 1.8 SCHEDULING

A. Unless otherwise specified, the construction schedules of the Sections 27 00 00 may be combined.

B. Submit schedule within 30 days after Notice To Proceed.

## 1.9 WARRANTY

A. Service must be rendered within 4 hours of system failure notification. Note any deviation – exceptions or improvements – to this requirement at the time of bid.

B. Refer to Sections listed in paragraph 1.01, C for specific subsystem warranty period requirements.

C. Manufacturers of the major system components shall maintain a replacement parts department and provide testing equipment when needed. A complete parts department or stocking distributor shall be located close enough to the job site area to supply replacement parts within a 4-hour period.

D. Warrant installed hardware, under normal use and service, to be free from defects and faulty workmanship during the warranty period. Keep the system in operating condition at no additional material or labor costs to the Owner during the warranty period.

E. The manufacturers shall demonstrate that a quality assurance program is in place to assure that the specifications are met. The program shall include, as a minimum, provisions for:
1. Incoming inspection of raw materials.
2. In-process inspection and final inspection of the product.
3. Calibration procedures of test equipment to be used in the qualifications of the product.
4. Recall procedures in the event that out of calibration equipment is identified.

F. Conformance to certain government standards on quality assurance may be required for some applications outlined in these specifications.

# PART 2 - PRODUCTS

## 2.1 GENERAL

A. Materials used shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards, other applicable federal, state, and local laws.

B. Product numbers listed in the 27 00 00 series sections are subject to change by the manufacturer without notification. In the event a product number is invalid or conflicts with the written description, notify the Owner in writing prior to ordering the material and performing any installation work. Provision and installation of the approved changed product will be at no additional cost to the Owner.

## 2.2 SUBSTITUTIONS

A. Requests for substitutions shall conform to the general requirements and procedure outlined in Division 1.

B. Where items are noted as "or equal", a product of equivalent function, design, construction, quality and performance will be considered. Include in the substitution request: catalog cuts, product information, and pertinent test data required to substantiate that the product is in fact equivalent to that specified. Only one substitution will be considered for each product specified.

C. Do not provide substitution material, processes or equipment without written authorization from the Engineer.

D. Substitutions shall be equivalent, in the opinion of the Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Specifications.

E. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment that, in the opinion of the Owner, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when "or equivalent" follows the manufacturers' names and model number(s).

F. Whenever any material, process or equipment is specified in accordance with a TIA/EIA specification, an ANSI specification, UL rating or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit supporting test data to substantiate compliance at no additional cost.

G. Pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on self, subcontractor's or other Contractor's work.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Conditions: Verify conditions, provided under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. Pathways: Verify that pathways and supporting devices, provided under other sections, are properly and permanently installed, and that temporary supports, devices, etc., have been removed.

C. Field Measurements: Verify dimensions of pathways, including length of pathways. For example, "true tape" the conduits to verify cabling distances.

### 3.2 FIELD QUALITY CONTROL

A. Staffing: Provide a qualified foreman who is in charge of the Work and who is present at the job site at times Work is being performed. Supervise the work force executing the Work. Perform the installation within the restraints of the construction schedule.

B. Project Management: Coordinate and attend weekly status meetings to review the overall progress and issues to be resolved throughout the course of construction. Prepare and distribute meeting agenda prior to and meeting notes after meetings in a format acceptable to the General Contractor.

C. Scheduling: Prepare an overall construction schedule based on the results of the planning meetings with the General Contractor. Issue schedule to General Contractor for approval. Prepare and issue updated schedules whenever there are modifications.

D. Inspection: Perform inspection after installation. Keep areas of work accessible and notify code authorities, or designated inspectors, of work completion released for inspection. Document completion, and inspection as required.

## 3.3 INSTALLATION

A. Conform to applicable federal, state and local codes, and telephone standards.

B. Coordinate the entire installation with the General Contractor, and their subcontractors, to meet the construction schedule. Include coordination meetings as required to fulfill this requirement.

C. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

D. Manufacturer's Instructions:
1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
2. Maintain jobsite file and comply with Material Safety Data Sheets (MSDS) for each product delivered to jobsite.

E. Adjusting:
1. Make changes and revisions to the system to optimize operation for final use.
2. Make changes to the system such that any defects in workmanship are corrected and cables and the associated termination hardware pass the minimum test requirements.

F. Protection:
1. Protect installed products and finish surfaces from damage during delivery and construction.
2. Provide protective coverings on adjacent surfaces for protection from dust.

## 3.4 REPAIR/RESTORATION

A. Replace or repair work completed by others that you deface or destroy. Pay the full cost of this repair/replacement.

B. Paint damaged areas to existing painted surfaces caused by Work.

C. Punch List:
1. Inspect installed work in conjunction with the General Contractor and develop a punch list for items needing correction.
2. Provide punch list to Owner for review prior to performing punch walk with Owner.

D. Re-Installation:
1. Make changes to adjust the system to optimum operation for final use. Make

changes to the system such that any defects in workmanship are correct and cables and the associated termination hardware passes the minimum test requirements.

2. Repair defects prior to system acceptance.

## 3.5 CLEANING

A. Clean daily. Remove temporary coverings and protection of adjacent work areas. Remove unused products, debris, spills, or other excess materials. Remove installation equipment.

B. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.

C. Repair or replace damaged installed products.

D. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Legally dispose of debris.

## 3.6 DEMONSTRATION

A. On completion of the acceptance test, schedule a time convenient with the Owner or Owner's Representative for instruction in the configuration, operation, and maintenance of the system.

B. Provide 4 hours, minimum, of on-site orientation and training by a factory-trained representative. Document dates and times of training, and submit a "sign in" sheet for individuals trained, as part of the close out documentation.

## 3.7 CERTIFICATION

A. Provide to Owner or Owner's Representative a written form of acceptance for signature. Corrections must be completed before Owner or Owner's Representative and Engineer will give acceptance.

**END OF SECTION**

# SECTION 27 05 28

# TELECOMMUNICATIONS BUILDING PATHWAYS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Telecommunications building pathways.

B. Related Sections:
1. Division 26 – Basic Materials and Methods, Conduit, Cable Tray, Boxes.
2. Comply with the Related Sections paragraph of Section 27 05 28.
3. Section 27 15 13 – Telecommunications Horizontal Cabling.
4. Section 27 13 10 – Telecommunications Backbone ISP Cabling.
5. Section 27 13 14 – Telecommunications Backbone OSP Twisted Pair Cabling.
6. Section 27 13 24 – Telecommunications Backbone OSP Fiber Optic Cabling.

### 1.2 REFERENCES

A. Comply with the References requirements of Section 27 00 00.

B. In additional to those codes, standards, etc., list in Section 27 00 00, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
1. ASTM A 510 Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
2. ASTM B 633 Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3.
3. ASTM A 653 Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process.
4. ASTM A 591 Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets.
5. ASTM A 123 Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel.

### 1.3 DEFINITIONS

A. Definitions as described in Section 27 00 00 shall apply to this section.

B. "Cable Hanger": A metal, most often steel, cable support device shaped (section view) similar to the letter J; alternately, a fabric strap. The device is available in different sizes supporting different quantities of cables, and is also available with different attachment hardware to be supported by different methods (e.g., wire support, beam flange clip, etc.).

C. "J-Hook": Another name for cable hangers.

### 1.4 SYSTEM DESCRIPTION

A. Work Covered Under Other Sections: Conduit, pull boxes, device boxes.

B. Base Bid Work:
1. The work under this section shall include the planning and coordination with General Contractor (and other trades) of telecommunications system building pathways, the furnishing of necessary materials, and the labor & associated services required to install pathways.
2. The Telecommunications Building Pathways consist of the following subsystems:

a. ISP innerduct, from MDF to IDFs, as shown on Drawings.
b. Primary Pathways: Cable Basket, Cable Tray, Liner Ring Pathway, including supports.
c. Secondary Pathways: Cable Hangers, including supports.
d. Surface Raceway.

## 1.5 SUBMITTALS

A. General: Conform to Submittal requirements as described in Section 27 00 00.

B. Quantity: Furnish quantities of each submittal as noted in Section 27 00 00.

C. Submittal Requirements at Start Of Construction:
1. Product Data Submittal.
2. Shop Drawings Submittal: Consisting of proposed changes to pathway route plans.

D. Submittal Requirements at Close Out: As-Built Drawings Submittal (can be combined with shop drawings of Section 27 15 13).

E. Substitutions: Requests for substitutions shall conform to the requirements and procedure in Section 27 00 00.

## 1.6 QUALITY ASSURANCE

A. Comply with Quality Assurance requirements of Section 27 00 00.

B. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to cable tray series of specifications.

## 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Comply with Delivery, Storage and Handling requirements of Section 27 00 00.

## 1.8 WARRANTY

A. Comply with Warranty requirements of Section 27 00 00.

# PART 2 - PRODUCTS

## 2.1 INSIDE PLANT INNERDUCT, RISER RATED

A. Application: Suitable for an indoor installation, typically within a riser system or backbone conduit, for the support of telecommunications fiber optic cables.

B. Description: Designed and manufactured as a continuously extruded corrugated pipe.

C. Material: Fabricated from Capron resin, or equivalent.

D. Manufacturers, or equal:
1. Carlon "Riser Guard" series innerduct.
2. Endot "Endocor/RI" series innerduct.
3. Pyramid "Fire Flex Riser Duct" series innerduct.

## 2.2 INSIDE PLANT INNERDUCT, PLENUM RATED

A. Application: Suitable for an indoor installation, typically within a riser system or backbone conduit, and within plenum spaces, such as above ceiling or within an access floor, for the support of telecommunications fiber optic cables.

B. Description: Designed and manufactured as a continuously extruded corrugated pipe.

C. Material: Fabricated from PVDF resin, or equivalent.

D. Manufacturers, or equal:
1. Carlon "Plenum Guard" series innerduct.
2. Endot "Endocor/PL" series innerduct.
3. Pyramid "Fire Flex Plenum Duct" series innerduct.

## 2.3 CABLE BASKET

A. Application: Suitable for indoor installation to support, store, and manage telecommunications cables, either overhead or mounted vertically on a wall.

B. Description: Cable basket shall be made of high strength steel wires and formed into a mesh pattern with intersecting wires welded together. Wire ends along sides (flanges) shall be rounded during manufacturing for safety of cables and installers. Straight section longitudinal wires shall be straight with no bends.

C. Materials and Finishes: Material and finish specifications for each wire basket type pathway are as follows:
1. Yellow Zinc Dichromate: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated yellow zinc dichromate in accordance with ASTM B633 SC2.
2. Paint: Straight sections shall be painted flat black over Yellow Zinc Dichromate.
3. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 Stainless Steel.

D. Refer to Drawings for sizes.

E. Manufacturers, or equal:
1. B-Line WB series.
2. Cablofil EZ-Tray series.
3. GS Metals Flextray series.
4. Chalfant Wire Mesh series.

## 2.4 CABLE HANGERS

A. Application: Suitable for indoor installation within ceiling space for the support of telecommunications cables.

B. Listings: UL 2043, for use in air handling spaces.

C. Manufacturers (or variation per installation method), or equal:
1. B-Line #BCH12-W2; hanger for up to 16 cables.
2. B-Line #BCH21-W2; hanger for up to 50 cables.
3. B-Line #BCH32-W2; hanger for up to 80 cables.
4. Erico #CAT12; hanger for up to 16 cables.
5. Erico #CAT2; hanger for up to 50 cables.
6. Erico #CAT32; hanger for up to 80 cables.
7. Panduit #JMJH2-X20; hanger for up to 30 cables.
8. Panduit #JMJH2W-X20; hanger for up to 30 cables, wall-mount type.

## 2.5 DROP WIRE

A. Application: Suitable for indoor installation within ceiling space into structure above (e.g., slab and/or deck) for the support of telecommunications support devices.

B. Listings: UL 2043, for use in air handling spaces.

C. Assembly shall be equipped with ceiling clip, pre-mounted fastening pin, plastic washer, and pre-tied wire.
   1. Fastening pin shall be 7/8".
   2. Wire shall be 12 gauge.

D. Manufacturer, or equal: Hilti #CC27 X-AL-H22P8T xx ft PT; drop wire assembly, xx foot wire – where "xx" is the length.

## 2.6 LINEAR RING SYSTEM ("SNAKE TRAY SERIES 201")

A. Application: Suitable for indoor installation within ceiling space for the support of telecommunications cables.

B. Description: Designed and manufactured as sections from a single wire spine and multiple support rings. The sections shall be hand-bendable in any direction along any plane, and shall not require tools, cutting, clipping or modifications to the structure of the tray to create the bend. The system shall allow cables to enter or exit in any direction at any point along the length of the sections, while also providing for the addition or removal of cables without modification or manipulation of the system, including hanging hardware.

C. Material: Wire, both spine and rings, shall be cold rolled steel in accordance with ASTM A510 and zinc plated in accordance with ASTM B633 SC2.

D. Finish: Yellow Zinc Dichromate plated in accordance with ASTM A633 type II SC2.

E. Accessories
   1. Accessories include, but are not limited to, threaded rod, coupling adapters, tray connectors, mounting brackets, turnout components and other necessary installation accessories.
   2. Accessories shall be made from high strength steel wires and/or sheet steel formed, welded and plated as required as per applicable ASTM standards.

F. Manufacturer: Cable Management Solutions
   1. #CM-201-3-8; Snake Tray Series 201, 3"D x 3"W ring size.
   2. #CM-201-425-8; Snake Tray Series 201, 4.25"D x 4.25"W ring size.
   3. #CM-201-6-8; Snake Tray Series 201, 4"D x 6"W ring size.
   4. #CM-201-425D-8; Snake Tray Series 201, 4.25"D x 4.25"W two sets of rings.
   5. #CB-10; tray connector.
   6. #WBN-201; wall mount bracket.
   7. #CBN-201; cabinet-top mount bracket.
   8. #TO-101; cable drop out.

# PART 3 - EXECUTION

## 3.1 GENERAL

A. Comply with the Execution requirements of Section 27 00 00.

## 3.2 EXAMINATION

A. Examine areas to receive overhead hanger/support system prior to the start of work within this section. Notify the General Contractor of conditions that would adversely affect the installation or subsequent utilization of the system. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Installer is responsible for the integrity of the structures to which the system is attached, including their capability of safely accepting the loads imposed as evaluated by a qualified engineer

## 3.3 INSTALLATION

A. Innerduct:
1. Provide innerduct for routing of fiber optic cables. The innerduct shall be continuous from originating room to destination room. Truncate the innerduct in either room prior to slack storage.
2. When routing through corridors, place innerduct in the cable tray / primary pathway/dedicated supports. When routing vertically through telecommunications rooms, support innerduct on vertical cable support (such as runway) and fasten using cable ties. When routing horizontally through telecommunications rooms, support innerduct on overhead cable support and fasten using cable ties. Install cable ties at 24-inch intervals.
3. Label innerducts at both ends. The label shall be visible to a technician standing at-ease.

B. Cable Basket:
1. Install cable basket pathway system in accordance with manufacturer's instructions and recognized industry practices, and ensure that the installed system complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
2. Install system at locations indicated on the drawings. Routes are diagrammatic in nature. Field verify route prior to installation.
3. Provide center-support hangers, trapeze hangers, or wall brackets to support/hang the cable basket pathway. If not shown in the Drawings, provide 3/8-inch diameter threaded rods for the trapeze hangers and/or center-support hangers. For wall brackets, use approved fasteners depending on the mounting substrate. Support separation shall conform to applicable codes.
4. Splice straight sections using hardware specifically designed for the purpose with serrated flange locknuts.

C. Cable Hangers:
1. Install hangers in accordance with recognized industry practices, to ensure that the installed system complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
2. Provide dedicated supports at sixty inches (60") separation, maximum, per a given route. Supports shall consist of #12 wire or ¼" threaded rod. Suspend wire or rod using components appropriate for the structure – e.g., powder-actuated clip fastener for wire, beam flange clip or angled flange clip for either wire or rod, or an embedded anchor for the threaded rod. Do not share support (wire/rod) with other trades. Do not support the hanger on ceiling grid support wires. Do not support the hanger from ductwork, piping, or other equipment hangers.
3. Install hangers six inches (6"), minimum, from light fixtures or other EMI source. Install hangers between six inches (6") and twelve inches (12") above ceiling grid.

D. Linear Ring Pathway System:

1. Install linear ring pathway system in accordance with manufacturer's instructions and recognized industry practices, and ensure that the installed system complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
2. Install system at locations indicated on the drawings. Routes are diagrammatic in nature. Field verify route prior to installation.
3. Provide dedicated supports for system at a maximum forty-eight inch (48") on center, per a given route. Supports shall consist of 3/8" (maximum size) threaded rod with appropriate hardware (nuts, washers, etc.). Do not share threaded rod with other trades.
4. Install system a minimum of six inches (6") from light fixtures, or other EMI sources. Install system between six inches (6") and twelve inches (12") above ceiling grid.
5. Provide materials necessary to properly support system from existing building construction per manufacturer's instructions, and meeting or exceeding recognized industry practices, and as appropriate for this project. Do not support from ductwork, piping, or other equipment hangers.
6. Splice system sections using UL classified connector bolt, supplied by the same manufacturer.
7. Ground system per NEC 70 Article 250. Provide approved connection bolt to join system sections such that the spine of the system is considered a bonding jumper. Properly bond system to approved ground, as per NEC Article 250. Provide external grounding strap at expansion joints, sleeves, crossovers, and at other locations where system continuity is interrupted.

**END OF SECTION**

SECTION 27 08 00

TELECOMMUNICATION TESTING

## PART 1 - GENERAL

### 1.1 SCOPE OF WORK

A. Section Includes: Testing of Telecommunications Backbone and Horizontal Cabling subsystems.

B. Related Sections:
1. Consult all other Sections and Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to completely test a complete and operable system.
2. Section 27 00 00 – Basic Telecommunications Requirements.
3. Section 27 13 10 – Telecommunications Backbone ISP Cabling.
4. Section 27 13 14 – Telecommunications Backbone OSP Twisted Pair Cabling.
5. Section 27 13 24 – Telecommunications Backbone OSP Fiber Optic Cabling.
6. Section 27 15 13 - Telecommunications Horizontal Cabling.

C. Products Furnished and Installed Under Other Sections: Telecommunications Cabling.

### 1.2 REFERENCES

A. Comply with Section 27 00 00 References requirements.

B. Additional references to those listed in Section 27 00 00.
1. TIA/EIA-526-14 ("OFSTP-14") Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
2. TIA/EIA-526-7 ("OFSTP-7") Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant.
3. TIA/EIA-455-171 Attenuation By Substitution Measurement – For Short-Length Multimode Graded-Index And Single-Mode Optical Fiber Cable Assemblies (a.k.a., FOTP-171).

### 1.3 DEFINITIONS

A. Refer to Definitions of Sections 27 00 00, 27 15 13, 27 13 10, 27 13 14, and 27 13 24.

B. In addition, the following list of terms as used in this specification shall be defined as follows:
1. "Adapter" (associated with fiber connectivity): Shall mean a connecting device joining 2 fiber connectors, either like or unlike.
2. "Channel": Shall mean a testing configuration which includes the Permanent Link and the line cord (at the workstation), the equipment cord, and, if a full crossconnection is implemented, a patch cord and the crossconnect termination/connecting apparatus.
3. "Connect": Shall mean install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
4. "Cord": Shall mean a length of cordage having connectors at each end. The term "Cord" shall be synonymous with the term "Jumper". The cord may be:
   a. Unshielded twisted pair.
   b. Fiber (multimode or singlemode), jacketed & buffered.

5. "Launch Cord": Shall mean the cord certified for use in fiber optic characterization testing, as described in this section.
6. "OTDR": Shall mean Optical Time Domain Reflectometer.
7. "Passive Link Segment": Shall mean the cable, connectors, couplings, and splices between two fiber optic termination units.
8. "Permanent Link": Shall mean the 'permanent' portion of the Horizontal cabling to each outlet with the test cords de-embedded from the measurements; this includes cable, consolidation point (if used), termination/connecting apparatus in the IDF and the connector at the outlet.
9. "System Cord": Shall mean the cord used in the operating electrical or optical circuit.
10. "Test Cord": Shall mean the cord certified for use in testing, as described in this section.

## 1.4 SYSTEM DESCRIPTION

A. Work Provided Under Other Sections:
1. Refer to Section 27 15 13 for a more complete System Description.
2. Backbone Cabling: The Backbone Cabling includes twisted pair and fiber cabling.
3. Horizontal Cabling: The Horizontal Cabling, in general, consists of multiple 4-pair Category 6 UTP cables to each outlet. Refer to the Drawings for specific requirements.

B. Base Bid Work:
1. Testing of a completed Telecommunications Cabling System, including:
a. Procedures Submittals.
b. Equipment Submittals.
2. Testing Requirements:
a. Fiber optic passive link segment(s):

**Table 270800-1.1:** Tests For Fiber Optic Passive Link Segments

| Subsystem | Type | Test | Direction | Wavelength |
|---|---|---|---|---|
| Backbone | Multimode | Characterization | Both | 850nm and 1300nm |
| Backbone | Singlemode | Characterization | Both | 1310nm and 1550nm |
| Backbone | Multimode | Passive Link Ins. Loss | One | 850nm and 1300nm |
| Backbone | Singlemode | Passive Link Ins. Loss | One | 1310nm and 1550nm |

b. Multipair/UTP cabling:

**Table 270800-1.2:** Tests For Multipair/UTP Cabling

| Subsystem | Type | Test | Configuration | Notes |
|---|---|---|---|---|
| Backbone | Riser | Wire map & length | - | - |
| Horizontal | CAT6 | Category 6 | Permanent Link | Per TIA/EIA-568-B.2-1 |

c. Record Documents, including test reports.

## 1.5 SUBMITTALS

A. Refer to Submittals of to Section 27 00 00 for procedural, quantity, and format requirements.

B. Preconstruction Submittal Requirements:
1. Testing Procedures Submittal, describing step-by-step procedures used by the field technicians.

2. Product Submittal, including cut sheets of testing equipment to be used (note all software/firmware versions as applicable) and certificate of last calibration.
3. Schedule Submittal, consisting of proposed schedule of work. This schedule may be combined with the schedule developed for 27 00 00 series Sections.

C. Submittal Requirements at Closeout: Record Documents.

D. Submittal Description: Record Documents.
1. Test Reports: Record documents submittal shall include test reports showing the following information:
   a. A title page which includes:
      1) Client Name.
      2) Project Name.
      3) Project Address.
      4) General Contractor name / Telecommunications Installer name.
      5) Date of Submittal.
   b. Individual tabs which break down the test results by building, and then by telecommunications room.
   c. All Backbone Fiber Optic "Post Installation" Passive Link Attenuation test results (utilize the forms provided in Part 4 of this specification for documentation of test results if the tester used does not have data storage capabilities) and Fiber Optic OTDR test results.
   d. All Backbone UTP test results.
   e. All Horizontal cable test results, per cable.
2. Furnish all test results on CD-ROM in their native data format and an exported Microsoft Excel compatible format.
   a. Include all necessary software to allow viewing and printing of individual test results.
   b. CD shall be labeled with the project name, contractor name, and date of submission.

## 1.6 QUALITY ASSURANCE

A. Comply with the Quality Assurance requirements of Section 27 00 00.

## 1.7 WARRANTY

A. Warrant the validity of the test results. Under no circumstances shall any cable's test results be substituted for another's. If a single instance of falsification is confirmed, the Contractor shall be liable for a complete retest of the cabling system at no additional cost to the Owner. This includes the retaining the services of a neutral party to observe all retesting.

# PART 2 - PRODUCTS

## 2.1 GENERAL

A. The manufacturer may change the product numbers listed in this Section at any time, as well as software and firmware versions. In the event this Section contains an invalid product number or conflicts with the written description, or specifies an out-of-date software and/or firmware version, notify the Engineer in writing prior to issuing submittals or field testing.

## 2.2 FIBER OPTIC LIGHT SOURCE

A. All connection interfaces shall be factory installed. No field-configurable adapters will be allowed at the light source.

B. Wavelengths output shall be continuous.

C. LED-based light source for multimode fiber testing shall have a:
1. Center wavelength of 850nm ± 30nm and 1300n ± 20nm.
2. Spectral width (FWHM) 30nm - 60nm at 850nm and 100nm - 140nm at 1300nm.
3. Minimum output power level of ≥14dBm.

D. VCSEL-based light source for multimode fiber testing shall have a:
1. Center wavelength of 850nm ± 30nm and 1300n ± 20nm.
2. Spectral width (FWHM) 30nm - 60nm at 850nm and 100nm - 140nm at 1300nm.
3. Minimum output power level of ≥14dBm.

E. LASER-based light source for singlemode fiber testing shall have a:
1. Center wavelength of 1310n ± 20nm and 1550n ± 20nm.
2. Spectral width (FWHM) of ≤5nm at 1310nm and ≤5nm at 1550nm.
3. Minimum output power level of ≥3dBm.

F. The light sources may contain internal lenses, pigtails, and modal conditioners, provided they meet the launch conditions as described in "Post-Installation" Passive Link Attenuation Testing Procedures (ref. PART 3 - EXECUTION).

G. Equipment shall be factory-calibrated within 12 months of testing date.

H. Equipment:
1. Agilent Technologies' WireScope 350 test set.
   a. #450-1070 Fiber SmartProbe testing adapter, multimode 850nm.
   b. #450-1080 Fiber SmartProbe testing adapter, multimode 1300nm.
   c. #450-2020 Fiber SmartProbe testing adapter, singlemode 1300nm.
   d. ScopeData management software (version 5.20 or higher).
2. Corning Cable Systems
   a. #OS-301 light source.
   b. #OS-302 light source.
   c. #OS-100D light source.
3. Fluke Networks' DSP-4300 test set
   a. #DSP-4300; "CableAnalyzer" test kit, loaded with firmware version 3.0.4.
   b. #DSP-FTA420S; 'Multimode' fiber testing adapter, LED-based (850nm, 1300nm).
   c. #DSP-FTA430S; 'Singlemode' fiber testing adapter, LASER-based (1310nm, 1550nm).
   d. #DSP-FTA440S; 'Gigabit' fiber testing adapter, VCSEL-based (multimode @ 850nm and singlemode @ 1310nm).
   e. LinkWare; "LinkWare" management software (latest version).
4. Laser Precision #5150 test set.

## 2.3 FIBER OPTIC POWER METER

A. The power meter for both multimode and singlemode testing must be capable of measuring relative or absolute power, and must be independent of modal distributions.

B. All power meters used must be calibrated and traceable to the National Bureau of Standards.

C. All power meters used shall have the following performance:
   1. Dynamic range of 0dBm to -40dBm, minimum.
   2. Accuracy of ±0.2dB.

D. Equipment shall be factory-calibrated within 12 months of testing date.

E. Equipment:
   1. Agilent Technologies' WireScope 350 test set
      a. #450-1070 Fiber SmartProbe testing adapter, multimode 850nm.
      b. #450-1080 Fiber SmartProbe testing adapter, multimode 1300nm.
      c. #450-2020 Fiber SmartProbe testing adapter, singlemode 1310nm.
      d. ScopeData management software (version 5.20).
   2. Corning Cable Systems
      a. #OTS-210 power meter, with data storage capacity.
      b. #OTS-310 power meter, with data storage capacity.
   3. Laser Precision #5025 test set.

## 2.4 FIBER OPTIC MANDREL

A. For jacketed (3.0 mm) fiber, mandrel diameter shall be 22 mm for 50/125 um fiber. For unjacketed buffered (0.9 mm) fiber, mandrel diameter shall be 25 mm for 50/125 um fiber.

B. Equipment: Fluke Networks: #NF-MANDREL-50; red mandrel for jacketed 50/125 um fiber.

## 2.5 FIBER OPTIC OTDR

A. Multimode Source Module:

| Wavelength | Dynamic Range | Attenuation Deadzone | Reflective Deadzone | Loss Resolution | Distance Accuracy |
|---|---|---|---|---|---|
| 850nm | 24dB | 6.5mt | 3.0mt | 0.001dB | 0.1mt |
| 1300nm | 27dB | 7.0mt | 3.0mt | 0.001dB | 0.1mt |

B. Singlemode Source Module:

| Wavelength | Dynamic Range | Attenuation Deadzone | Reflective Deadzone | Loss Resolution | Distance Accuracy |
|---|---|---|---|---|---|
| 1310nm | 40dB | 6.0mt | 3.5mt | 0.001dB | 0.1mt |
| 1550nm | 28dB | 12.0mt | 3.5mt | 0.001dB | 0.1mt |

C. Equipment, including main unit and source modules, shall be factory-calibrated within 12 months of testing date.

D. Equipment:
   1. Agilent Technologies #8147, for multimode & singlemode systems
   2. Corning Cable Systems,
      a. 2001HR, for multimode & singlemode systems.
      b. 340 OTDR Plus Multitester II.
      c. MiniOTDR+, for multimode & singlemode systems.
   3. Tektronix,
      a. TFP2A FiberMaster.
      b. TFS3031 TekRanger2.

## 2.6 FIBER OPTIC TEST CORDS

A. Multimode Fiber Optic Test Cord:
   1. The fiber of the multimode test cord(s) shall have the core diameter and numerical aperture nominally equal to that of the multimode fiber optic passive link.
   2. The length of test cords used for insertion loss testing shall be between 1m and 5m.
   3. The connectors of the test cords shall be compatible with the connector types of the light source and the power meter: The connector of the test cords shall be that which the light source accepts.
   4. The connectors shall exhibit <= 0.5dB loss per connection @ both 850nm and 1300nm, as measured per FOTP-171 D2.

B. Singlemode Fiber Optic Test Cord:
   1. The fiber of the singlemode test cord(s) shall have the mode field diameter nominally equal to that of the singlemode fiber optic passive link.
   2. The length of test cords used for insertion loss testing shall be between 1m and 5m.
   3. The connectors of the test cords shall be compatible with the connector types of the light source and the power meter: The connector of the test cords shall be that which the light source accepts.
   4. The connectors shall exhibit <= 0.5dB loss per connection @ both 1300nm and 1550nm, as measured per FOTP-171 D3.
   5. All singlemode connectors shall inhibit Fresnel reflections (i.e., have a "PC" finish).

## 2.7 CATEGORY 6 HORIZONTAL CABLE TESTER

A. Equipment shall meet TIA/EIA-568B.2 Addendum 1 requirements for Level III accuracy.

B. Test Standards (minimum): TIA Category 6 (per TIA/EIA-568B.2 Addendum 1); ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-T, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5

C. Areas of Test Measurement (minimum): Wire Map; Length; Insertion Loss; Near End Crosstalk (NEXT) loss, at both master unit and remote unit; Power Sum NEXT (PSNEXT) loss, at both master unit and remote unit; Equal Level Far End Crosstalk (ELFEXT), at both master unit and remote unit; Power Sum ELFEXT, at both master unit and remote unit; Return Loss (RL), at both master unit and remote unit; Propagation Delay and Delay Skew; Attenuation-to-Crosstalk Ratio (ACR), at both master unit and remote unit; Power Sum ACR (PSACR), at both master unit and remote unit; Characteristic Impedance; DC Loop Resistance.

D. Equipment: Agilent Technologies.
   1. #N2600A-100; "WireScope 350" test kit (main unit, remote unit, CAT6 permanent link probe, CAT6 channel probe, accessories), loaded with firmware version 3.1.1.
   2. "ScopeData Pro" reporting and documentation software latest version.

E. Equipment: Fluke Networks.
   1. #DTX-1200 or #DTX-1800; "DTX CableAnalyzer" test kit (main unit, remote unit, CAT6 permanent link adapters, CAT6 channel adapters, accessories), loaded with latest version of firmware.

2. #DSP-4300; "CableAnalyzer" test kit (main unit, remote unit, CAT6 permanent link adapters, CAT6 channel adapters, accessories), loaded with firmware version 3.0.4.
3. "LinkWare" reporting and documentation software (version 1.1, or higher).

## 2.8 BACKBONE UTP CABLING TESTERS

A. Wire Map (continuity, opens, shorts, crossed pairs, split pairs) tester, or equal: Siemon #MT-5000 test unit, with 25-pair adapter.

B. Length tester, or equal: Harris #TS-90 test unit.

# PART 3 - EXECUTION

## 3.1 SCHEDULING

A. Prepare a schedule for testing activities based on the schedule developed in Sections 27 15 13, 27 13 10, 27 13 14, and 27 13 24. Update testing schedule when changes in the cabling construction schedule occur.

B. Schedule both the Engineer of Record and a representative of the test equipment manufacturer for a demonstration of testing methods. Execute a demonstration of testing methods with aforementioned parties prior to 'production' testing activities. Test reports and acceptance testing will not be accepted without proof of methods demonstration.

## 3.2 FIELD QUALITY CONTROL

A. Complete testing as delineated below prior to system acceptance.

B. Permanently record all test results and presented in a format acceptable to the Owner or Engineer before system acceptance.

C. Remove and replace with new, at no cost to the Owner, any cables or conductors (copper or glass) failing to meet the indicated standards. The Owner will not accept the installation until testing has indicated a 100% availability of all cables and conductors or the Owner has approved any deviation from this requirement.

D. Calibrate test sets and associated equipment per the manufacturers printed instructions at the beginning of each day's testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.

## 3.3 "PRE-INSTALLATION" CONTINUITY TESTING PROCEDURES

A. Ensure fiber continuity of all fiber strands of all cables prior to installation.

B. Reports from "pre-installation" continuity testing are not required to be submitted at project close out.

## 3.4 BACKBONE FIBER OPTIC CHARACTERIZATION TESTING

A. Test fiber optic passive links per "Base Bid Requirements" in Part 1 of this Section.

B. Precautions:
1. Adhere to the equipment manufacturer's instructions during testing activities.

2. Prior to any testing activity or any measurements taken, complete the following activities:
   a. Ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for however long it takes to bring the test equipment to reach room temp).
   b. Clean all launch cords and system cords (if applicable) connectors and all adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.
3. Do not power off OTDR's light source during testing activity.
4. Do not remove launch cord from the OTDR's light source at any time (unless the testing is complete or the equipment is being put away for the evening, or during trouble shooting).
5. Do not bend the launch cord smaller than 20 times the cord diameter during testing activities (this may induce loss into the cord reducing the accuracy of the measurement).
6. Fully charge power source before each day's testing activity, if applicable.

C. "Post-Installation" Characterization Testing Procedures:
1. Equipment settings / measurement parameters:
   a. Index of Refraction: match cable-under-test fiber parameters; default settings as follows:

| | | | |
|---|---|---|---|
| Multimode | Corning 50/125 Infinicor | 1.483 @ 850nm | 1.483 @ 1300nm |
| | SYSTIMAX 50/125 | 1.483 @ 850nm | 1.478 @ 1300nm |
| Singlemode | SYSTIMAX | 1.466 @ 1310nm | 1.467 @ 1550nm |
| | Corning SMF-28 | 1.4675 @ 1310nm | 1.4681 @ 1550nm |

   b. Pulse Width: multimode: 20ns; singlemode: 50 ns.

| | |
|---|---|
| Multimode | 4 ns for cable lengths up to 500 meters |
| 50/125 | 20 ns for cable lengths from 250 meters to 2,000 meters |
| Singlemode | 10 ns for cable lengths up to 2,000 meters |
| | 50 ns for cable lengths from 2,000 meters to 20 kilometers |

   c. Backscatter:
      1) Multimode: -67dB @ 850nm, -74dB @ 1300nm.
      2) Singlemode: -74dB @ 1310nm and 1550nm.
   d. Event Threshold: 0.05dB for both multimode and singlemode.
   e. Reflection Threshold:
      1) Multimode: -45dB.
      2) Singlemode: -60dB.
   f. Fiber Break/End-Of-Fiber: 3dB for both multimode and singlemode.
2. Waveform: The waveform shall be real-time/normal density.
3. Obtain measurements using a 'launch' cord connected to the test instrument and the cable-under-test.
   a. The fiber of the launch cord shall match the fiber of the cable-under-test in physical and performance parameters (such as type, core/cladding size, index of refraction, refractive profile). The fiber of the launch cord should match the fiber of the cable-under-test in manufacturer and product.
   b. The length of the launch cord shall be between 25 meters and 100 meters.
4. Review the results of each test and bring to the attention of the Engineer all fibers that do not meet the manufacturer's allowed loss for splices and connectors, or fibers that do not meet the length of the overall cable length.

D. Record Documents:
1. Test reports shall match the cable and fiber IDs as labeled in the field – i.e., the ID on the cable label/fiber port label shall be the same as what is associated with the electronic and printed test record.
2. The units for distance measurements (i.e., the "X" axis of the graph) shown on

the print of the test measurements shall be feet.

3. For the traces, the x- and y-axis scales of a given cabling link shall be identical. Preferably, all reports shall be printed with identical scales on both x- and y-axis.
4. The launch cord must be shown in the trace of the printed test report.
5. Measurements shall carry a precision through one significant decimal place (minimum).
6. Each test report shall contain the following information (not necessarily in this order):
   a. Project name.
   b. General Contractor name / Telecommunications Installer name.
   c. Cable identifier, fiber number, and fiber type (e.g., "multimode").
   d. Measurement direction.
   e. Date measurement was obtained.
   f. Operator (name an company).
   g. Test equipment model and serial number(s).
   h. Set up parameters (minimum - pulse width, refractive index, event threshold.).
   i. Wavelength.
   j. OTDR trace.
   k. Length of fiber.
   l. Overall link loss.
7. For each passive cabling link, include either a schematic graphic or narrative accurately describing the test set up as a preface to the test reports. In other words, show the launch cord with length, expected events with distances, etc. This information will eliminate many questions the Engineer will have while reviewing the reports.

## 3.5 BACKBONE FIBER OPTIC PASSIVE LINK INSERTION LOSS TESTING

A. Test fiber optic passive links per "Base Bid Requirements" in Part 1 of this Section.

B. Launch Conditions:
   1. For passive link insertion loss testing for multimode fibers, the modal launch condition from the light source shall be characterized as Category 1 per OFSTP-14.
   2. For passive link insertion loss testing of singlemode fibers:
      a. Use the launch conditions, as described in FOTP-78.
      b. Employ a method to remove high-order propagating modes, as described in FOTP-77.

C. Test Methods:
   1. The passive link insertion loss testing of multimode fibers shall be performed according to "Test Method B: One Jumper Reference", per OFSTP-14, for 'permanent' links, and shall be performed according to "Test Method C: Three Jumper Reference", per OFSTP-14, for 'channel' links.
   2. The passive link insertion loss testing of singlemode fibers shall be performed according to "Test Method A.1: One Jumper Measurement", per OFSTP-7.

D. Precautions:
   1. Adhere to the equipment manufacturer's instructions during testing activities.
   2. Prior to any testing activity or any measurements taken:
      a. Ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or for however long it takes to bring the test equipment to reach room temp).
      b. Power on the light source and power meter for at least 5 minutes.
      c. Clean all test cords & system cords (if applicable) connectors and all adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.

3. Do not power off light source or the power meter during testing activity.
4. Do not remove Test Cord #1 from the light source at any time (unless the testing is complete or the equipment is being put away for the evening).
5. Do not bend the test cords smaller than 20 times the cord diameter (this may induce loss into the cord reducing the accuracy of the measurement).
6. Fully charge power sources before each day's testing activity.

E. Passive Link Insertion Loss Testing Procedures:
1. Test Equipment Set Up:
   a. Follow the test equipment manufacturer's initial adjustment and set up instructions.
   b. If the power meter has a Relative Power Measurement Mode, select this mode.
   c. If the meter can display power levels in dBm, select this unit of measurement to simplify subsequent calculations.
   d. Set the light source and power meter to the same wavelength.
2. Test Cord Performance Verification:
   a. Connect Test Cord #1 between the light source and the power meter.
   b. The value displayed on the power meter is the reference power ($P_{ref}$) measurement. If the power meter has a relative power measurement mode, enter this reference power measurement ($P_{ref}$) value into the meter. If it does not, hand-write $P_{ref}$ onto the record documents for future reference.
   c. Disconnect Test Cord #1 from the power meter. Do not disconnect Test Cord #1 from the light source.
   d. Connect the 'open' end of Test Cord #1 to an adapter (of matching connector type). Connect one end of Test Cord #2 to the adapter and the other end of Test Cord #2 to the power meter.
   e. The value displayed on the power meter is the power measurement ($P_{sum}$). If the power meter is in Relative Power Measurement Mode, the meter reading represents the test cord #2 connection attenuation. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the connection attenuation:
      1) If $P_{sum}$ and $P_{ref}$ are in the same logarithmic units (dBm, dBu, etc): Connection Attenuation (dB) = $\left| P_{sum} - P_{ref} \right|$.
      2) If $P_{sum}$ and $P_{ref}$ are in watts: Connection Attenuation (dB) = $\left| 10 \times \log_{10} [P_{sum}/P_{ref}] \right|$.
      3) The measured connection attenuation must be less than or equal to the value found in Table 3 (below).
   f. Flip the ends of Test Cord #2 so that the end connected to the power meter is now connected to the adapter, and the end connected to the adapter is now connected to the power meter.
   g. The meter reading is the reversed Power Measurement ($P_{sum}$). Perform the proper calculations if not using Relative Power Measurement Mode.
   h. Verify that both connection attenuation measurements are less than or equal to the value found in the following table:

| | ST or SC Cord | Mini-Connector Cord |
|---|---|---|
| Multimode (50/125) | 0.50 dB Max | 0.20 dB Max |
| Singlemode | 0.55 dB Max | 0.30 dB Max |

   i. If both measurements are found to be less than or equal to the values found in Table 1, test cord #1 is acceptable for testing purposes. Unacceptable attenuation measurements may be attributable to test cord # or test cord #2. Examine each cord with a portable microscope and clean, polish, or replace if necessary.
   j. Repeat this test procedure from the beginning reversing the test cords in order to verify the performance of test cord #2.

3. Determine the Launch Category of the Light Source:
   a. The launch category of a light source can be determined by measuring its Coupled Power Ratio (CPR). The CPR is a measurement of the modal power distribution launched into a multimode fiber. A light source that launches a higher percentage of its power into the higher order modes of a multimode fiber produces a more over-filled condition and is classified as a lower Category than a light source that launches more of its power into just the lower order modes producing an under-filled condition. Under-filled conditions result in lower link attenuation, while over-filled conditions produce higher attenuation. Therefore, adjusting the acceptable link attenuation to compensate for a light source's launch characteristics increases the accuracy of the test procedure.
   b. Provide two test cords, one multimode (Test Cord #1) and one singlemode (Test Cord #2). Both cords shall be directly terminated on connectors that are compatible with the light source and power meter.
      1) The fiber of the multimode test cord shall have the core diameter and numerical aperture nominally equal to those of the permanent link.
      2) The fiber of the singlemode test cord shall contain Class IVa singlemode fiber, with a mode field diameter of 5.0□m ±0.5□m for 850nm tests and 9.0□m ±1.0□m for 1300nm tests.
   c. Connect test cord #1 between the light source and the power meter. Avoid placing bends in the cord that are less than 4 inches in diameter.
   d. The meter reading is the Reference Power Measurement ($P_{ref}$). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ($P_{ref}$) value into the meter. If it does not, hand-write $P_{ref}$ for future reference.
   e. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
   f. Connect test cord #2 between the power meter and test cord #1, using an appropriate adapter between the test cords: Test cord #2, the singlemode cord, shall include a high order mode filter. This can be accomplished by twice wrapping the cord around a 1.2" diameter (30-mm) mandrel.
   g. The meter reading is the Power Measurement ($P_{sum}$). If the power meter is in Relative Power Measurement Mode, the meter reading represents the CPR. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the CPR:
      1) If $P_{sum}$ and $P_{ref}$ are in the same logarithmic units (dBm, dBu, etc): CPR (dB) = $\left| P_{sum} - P_{ref} \right|$.
      2) If $P_{sum}$ and $P_{ref}$ are in watts: CPR (dB) = $\left| 10 \times \log_{10} [P_{sum}/P_{ref}] \right|$.

Coupled Power Ratio (CPR) in dB, for 50/125μm Fiber:

| | Cat-1 Overfilled | Cat-2 | Cat-3 | Cat-4 | Cat-5 Underfilled |
|---|---|---|---|---|---|
| 850nm source | 20 – 24 | 16 – 19.9 | 11 – 15.9 | 7 – 10.9 | 0 – 5.9 |
| 1300nm source | 16 – 21 | 12 – 15.9 | 8 – 11.9 | 4 – 7.9 | 0 – 3.9 |

4. Multimode Insertion Loss Measurement:
   a. After setting up the test equipment, verifying the performance of the test cords, and determining the light source's CPR, the insertion loss of the passive link segments can be measured.
   b. Connect test cord #1 between the light source and the power meter.
   c. The meter reading is the Reference Power Measurement ($P_{ref}$). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ($P_{ref}$) value into the meter. If it does not, hand-write $P_{ref}$ for future reference and to be included in the Record Documents.
   d. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.

e. Connect test cord #1 to the passive link segment 'input'.
f. At the opposite end of the passive link segment, connect test cord #2 to the link segment 'input' and the power meter.
g. The meter reading is the Power Measurement ($P_{sum}$). If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the insertion loss:
   1) If $P_{sum}$ and $P_{ref}$ are in the same logarithmic units (dBm, dBu, etc): Link Segment Attenuation (dB) = $\left| P_{sum} - P_{ref} \right|$.
   2) If $P_{sum}$ and $P_{ref}$ are in watts: Link Segment Attenuation (dB) = $\left| 10 \times \log_{10} [P_{sum}/P_{ref}] \right|$.
h. Record $P_{sum}$ for inclusion into the Record Documents. Refer to Records (ref. PART 3: EXECUTION) for all of the information to record.

5. Singlemode Insertion Loss Measurement:
   a. After setting up the test equipment and verifying the performance of the test cords, the insertion loss of the passive link segments can be measured.
   b. Connect test cord #1 between the light source and the power meter.
   c. The meter reading is the Reference Power Measurement ($P_{ref}$). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ($P_{ref}$) value into the meter. If it does not, hand-write $P_{ref}$ for future reference and to be included in the Record Documents.
   d. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
   e. Connect test cord #1 to the passive link segment 'input'.
   f. At the opposite end of the passive link segment, connect test cord #2 to the link segment 'input' and the power meter.
   g. The meter reading is the Power Measurement ($P_{sum}$). If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the insertion loss:
      1) If $P_{sum}$ and $P_{ref}$ are in the same logarithmic units (dBm, dBu, etc): Link Segment Attenuation (dB) = $\left| P_{sum} - P_{ref} \right|$.
      2) If $P_{sum}$ and $P_{ref}$ are in watts: Link Segment Attenuation (dB) = $\left| 10 \times \log_{10} [P_{sum}/P_{ref}] \right|$.
   h. Record $P_{sum}$ for inclusion into the Record Documents. Refer to Records (ref. PART 3: EXECUTION) for all of the information to record.

6. Acceptable Measurement Values:
   a. Any cabling links failing to meet the criteria described in this specification shall be removed and replaced, at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.
   b. The general insertion loss equation for any link segment is as follows:
      1) Insertion loss = <cable loss> + <connection loss> + <splice loss> + <CPR adjustment>.
      2) Note: A connection is defined as the joint made by two mating fibers terminated with remateable connectors (e.g., ST, SC, etc).
   c. 50/125µm Multimode Insertion Loss Coefficients
      1) Cable Loss = Cable Length (km) x (3.0 dB/km @ 850-nm or 1.0B/km @ 1300-nm).
      2) Connection Loss (ST or SC Connectors) = (Connections x 0.4 dB) + 0.42 dB.
      3) Connection Loss (Other mini-connectors) = (Connections x 0.2 dB) + 0.24 dB.
      4) Splice Loss = Splices x (0.05 dB for fusion or 0.10 dB for mechanical).

5) CPR Adjustment = See following table:

| | Cat-1 | Cat-2 | Cat-3 | Cat-4 | Cat-5 |
|---|---|---|---|---|---|
| Links with ST or SC Connectors | +0.50 | 0.00 | -0.25 | -0.50 | -0.75 |
| Links with mini-connectors | +0.25 | 0.00 | -0.10 | -0.20 | -0.30 |

d. Singlemode Insertion Loss Coefficients:
   1) Cable Loss = Cable Length (km) x (0.50 dB/km @ 1310-nm or 0.50 dB/km @ 1550-nm).
   2) Connection Loss (ST or SC Connectors) = (Connections x 0.44 dB) + 0.42 dB.
   3) Connection Loss (Other mini-connectors) = (Connections x 0.24 dB) + 0.24 dB.
   4) Splice Loss = Splices x (0.07 dB for fusion or 0.15 dB for mechanical).
   5) CPR Adjustment = Not applicable for singlemode.

F. Record Documents:
1. All cable and fiber IDs of the test reports shall match the IDs as labeled in the field – i.e., the ID on the cable label/fiber port label shall be the same as what is entered into the stored test result in the power meter.
2. Measurements shall carry a precision through one significant decimal place (minimum).
3. Each test report shall contain the following information (not necessarily in this order):
   a. Project name and address.
   b. General Contractor name / Telecommunications Installer name.
   c. Operator's name(s).
   d. Date of measurement.
   e. Test equipment - manufacturer, model, and serial number.
   f. Cable identifier, fiber and fiber type.
   g. Measurement direction.
   h. Wavelength, and.
   i. Measured loss values.

## 3.6 BACKBONE TWISTED PAIR CABLING TESTING REQUIREMENTS AND PROCEDURES

A. Testing Requirements:
1. Test backbone multipair cabling per "Base Bid Requirements" in Part 1 of this Section.
2. The installation will be accepted when testing has indicated a 100% availability of all terminated pairs or the Owner has approved any deviation from this requirement.

B. Testing Procedures:
1. Test wire map and continuity for all pairs.
2. Test length for 2% of pairs of each cable. None of the pairs tested for length shall be of the same 25-pair binder group.

C. Record Documents:
1. All cable and pair IDs of the test reports shall match the IDs as labeled in the field – i.e., the ID on the cable label/termination label shall be the same as what appears on the test reports.
2. Measurements shall carry a precision through no significant decimal place.
3. Each test report shall contain the following information (not necessarily in this order):
   a. Project name and address.

b. General Contractor name / Telecommunications Installer name.
c. Operator's name(s).
d. Date of measurement.
e. Test equipment - manufacturer, model, and serial number.
f. Cable identifier and pair numbers.
g. Overall test result, and.
h. Measured values of minimum requirements.

## 3.7 HORIZONTAL CATEGORY 6 TESTING PROCEDURES

A. Precautions:
1. Adhere to the equipment manufacturer's instructions during all testing.
2. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or for however long it takes to bring the test equipment to reach room temp).
3. Fully charge power sources before each day's testing activity.

B. Test Equipment Set Up:
1. Set up the tester to perform a full Category 6 test, as a Permanent Link configuration.
2. If the tester has the capability, set the cable type as product specific setting. If not, set as generic Category 6.
3. Set the tester to save the full test results (all test points, graphs, etc.).
4. Save the test results with the associated cable link identifier to match that as specified in Section 27 15 13.
5. Calibrate the test set per the manufacturers instructions.

C. Acceptable Test Result Measurements:
1. Links which report a Fail, Fail* or Pass* for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
2. Any reconfiguration of link components required as a result of a test Fail, must be re-tested for conformance.
3. Any cabling links failing to meet the criteria described in this specification shall be removed and replaced, at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.
4. Minimum measurement requirements:

| | |
|---|---|
| Wire Map | All pairs of the cabling link shall be continuous and terminated correctly at both ends. No exceptions shall be accepted. |
| Length | The maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration shall be 94 meters, including test cords. |
| Insertion Loss | The acceptable insertion loss measurements for any Category 6 cabling link shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1. |
| Worst Pair-to-Pair Near End CrossTalk (NEXT) Loss | The acceptable worst pair-to-pair NEXT loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1. |
| Power Sum NEXT Loss | The acceptable power sum PS-NEXT loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1. |
| Worst Pair- | The acceptable worst pair-to-pair ELFEXT and loss for any |

| | |
|---|---|
| to-Pair ELFEXT and FEXT Loss | Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1. |
| Power Sum ELFEXT and FEXT Loss | The acceptable PS-ELFEXT and loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1. |
| Return Loss | The acceptable return loss measurements for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1. |
| Propagation Delay and Delay Skew | The acceptable propagation delay and delay skew measurements for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1. |

D. Record Documents: For each Horizontal Category 6 test measurement, record the following information:
1. Project name and address.
2. General Contractor name / Telecommunications Installer name.
3. Operator's name(s).
4. Date of measurement.
5. Ambient temperature.
6. Test equipment - manufacturer, model, and serial number.
7. Cable identifier.
8. Overall test result, and
9. Measured values of minimum requirements.

**END OF SECTION**

# SECTION 27 15 13

# TELECOMMUNICATIONS HORIZONTAL CABLING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Horizontal Cabling (subsystem of Telecommunications Cabling Infrastructure).

B. Related Sections:
1. Comply with the Related Sections paragraph of Section 27 00 00.
2. Section 27 05 28 - Telecommunications Building Pathways.

C. Products Furnished and Installed Under Another Section:
1. Conduits, sleeves, and other pathway systems for building distribution.
2. Conduit stubs and device (back) boxes for devices/outlets.
3. Surface raceway – base, cover, and device plates.

### 1.2 REFERENCES

A. Comply with the References requirements of Section 27 00 00.

### 1.3 DEFINITIONS

A. Refer to Section 27 00 00 for Definitions.

B. In addition, the following list of terms as used in this specification shall be defined as follows:
1. "CAT6": Category 6.
2. "Channel": End to end transmission path; e.g., the entire portion of the horizontal cabling to each outlet consisting of the Permanent Link, line cord (at the workstation), patch cord, and, if a full cross-connection is implemented, the cross-connect termination/connecting apparatus and equipment cord.
3. "CMP": Communications Media Plenum, plenum rating; synonymous with "MPP."
4. "CMR": Communications Media Riser, riser rating; synonymous with "MPR."
5. "FEP": Fluorinated Ethylene Propylene.
6. "Permanent Link": Test configuration for a horizontal cabling link excluding test cords, connections at the ends of the test cords, patch cords, equipment cords, line cords; e.g., the 'permanent' portion of the horizontal cabling to each outlet consisting of cable, consolidation point (if used), termination/connecting apparatus in the Telecommunications Room and the connector at the outlet.
7. "PVC": PolyVinyl Chloride.
8. "UTP": Unshielded Twisted Pair.

### 1.4 SYSTEM DESCRIPTION

A. Base Bid Work
1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working telecommunications Horizontal Cabling System installation described in these specifications.
2. Consider horizontal cabling as shown on Drawings to be base bid work, unless otherwise noted.

B. In general, the base bid work includes:
   1. Preconstruction Submittals.
   2. Horizontal cables, terminations, and outlets.
   3. Cable management.
   4. Patch cords and cross-connects.
   5. Cable identification tags and system labeling.
   6. Record Documents.
   7. Warranty.

## 1.5 SUBMITTALS

A. Comply with the Submittals article of Section 27 00 00 for procedural, quantity, and format requirements.

B. Preconstruction Submittal Requirements:
   1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications and specifications.
   2. Shop Drawings Submittal, consisting of proposed changes to cable routing, or termination locations/configurations.
   3. Typical Outlet Sample, including faceplate, faceplate label, connectors/jacks, port labels, cables (about 12" sample), and cable label.

C. Closeout Submittal Requirements:
   1. As-Built Drawings.
   2. Cross-connection records/cut sheets.
   3. O & M Manuals.

## 1.6 QUALITY ASSURANCE

A. Comply with the Quality Assurance requirements of Section 27 00 00.

B. Contractor Qualifications
   1. In addition to the Contractor Qualifications requirements of Section 27 00 00, the Telecommunications Installer shall be a Panduit Certified Installer (PCI), certified by Panduit Corporation, and shall be capable of providing an extended warranty in the CertificationPlus system warranty program.
   2. Provide evidence in the bid submission of certification in the PCI program. Evidence shall consist of a "Certification Of Participation" issued by Panduit Corp listing the Telecommunications Installer's company name.

## 1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with the Delivery, Storage and Handling requirements of Section 27 00 00.

## 1.8 WARRANTY

A. The telecommunications horizontal cabling system, as specified in this section, shall receive a CertificationPlus system warranty. This extended warranty shall cover parts and labor for the duration of the extended warranty. This extended warranty shall also cover electrical performance of cabling system to the specific category per ANSI/TIA/EIA-568-B performance criteria for Permanent Link.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

A. Comply with the Substitutions requirements of Section 27 00 00.

### 2.2 HORIZONTAL CABLE

A. Application: Suitable for indoor installation.

B. Conductors:
1. Insulated Conductors: 23 AWG solid-copper fully-insulated with a flame retardant thermoplastic material (material = PVC, or equivalent).
2. Twisted Pairs: Two insulated conductors twisted to form a pair (twisted pair), and individually color-coded to industry standards (ANSI/ICEA Publication S-80-576-1994, and EIA-230).

C. Cable Sheath:
1. The cable shall be unshielded.
2. Outer jacket shall be seamless (material = LS-PVC, or similar) applied to and completely covering the internal components (four twisted pairs).
3. Flame Rating: NEC (Article 800) rated as CMP, and UL listed as such.
4. Cable sheath shall be round.

D. Electrical Performance: Meet or exceed TIA/EIA-568-B.2-1 and ISO/IEC 11801 requirements for CAT6 UTP cabling.

E. Packaging: Cable shall come as 1,000 foot put-ups packaged in a box.

F. Manufacturer: Panduit, or equal by Berk-Tek, General Cable, SYSTIMAX, CommScope, or Belden:
1. #PUP6004BU-U, "TX6000" CAT6 UTP CMP, Blue.
2. #PUP6004GY-U, "TX6000" CAT6 UTP CMP, Gray.

### 2.3 MODULAR PATCH CORDS

A. Application: Suitable for indoor installation within a telecommunications room or workstation environment. Cords shall be assembled from a single, continuous length of cordage, homogenous in nature, and shall be terminated at both ends via 8 position modular plugs. Splices are not permitted anywhere.

B. Cordage:
1. Insulated Conductors: 24 AWG stranded copper, fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
2. Twisted Pairs: Two insulated conductors "twisted" into a "pair" (twisted pair), and individually color-coded.
3. Sheath shall be unshielded, flame-retardant polyvinyl chloride (PVC) jacketed.
4. Flame Rating: NEC CM (or higher) rated and UL listed as such.

C. Electrical Performance: Comply with TIA/EIA 568-B for CAT6 UTP patch cords and Channel requirements (minimum).

D. Manufacturer: Panduit #UTPSPx ("x" varies for length).

## 2.4 CROSSCONNECT WIRE

A. Application: Suitable for indoor installation within a 110-based crossconnect system. Each and every crossconnect wire shall be manufactured from a single, continuous length of insulated wire, homogenous in nature. Splices are not permitted anywhere.

B. Factory splices of insulated conductors are expressly prohibited.

C. Conductors:
   1. Insulated Conductors: Conductors shall be 24 AWG solid copper. Conductors shall be fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
   2. Twisted Pairs: Two insulated conductors shall be "twisted" into a "pair" (twisted pair). Twisted pairs shall be individually color coded.

D. Manufacturer: General, or equal:
   1. #7041973; crossconnect wire, 1 pair, Whi-Red / Red-Whi.
   2. #7042047; crossconnect wire, 1 pair, Whi-Blu / Blu-Whi.

## 2.5 PATCH PANEL

A. Application: Patch panel shall be suitable for installation within a telecommunication room for the termination of the CAT6 UTP 4-Pair Cable (specified herein), and shall be horizontally oriented for a rack-mounted configuration.

B. Patch panel shall have discrete ports, fully compatible with the connectors / modular jacks – refer to this section for connectors.

C. Patch panels shall be capable of supporting, organizing, labeling and patching/crossconnecting between the horizontal termination field and the equipment and/or the equipment termination field.

D. Manufacturer: Panduit #CPPL24M6BL; 24-port discrete patch panel – less connectors/modular jacks.

## 2.6 WORKSTATION OUTLETS

A. Faceplate for Flush Mount Outlets:
   1. Refer to outlet schedule in the Drawings for port quantity per outlet type.
   2. Faceplate shall include required accessories, such as icons, blank inserts, and labels. Faceplate shall be by the same manufacturer as the connectors.
   3. Faceplate shall be "Executive" series, "IE" color.
   4. Manufacturer: Panduit:
      a. #CFPE2IE; Mini-Com line Executive series faceplate, 2-port.
      b. #CFPE4IE; Mini-Com line Executive series faceplate, 4-port.

B. Faceplate for Wall Phone Outlets:
   1. Faceplate for wall phone outlets shall come equipped with 1 modular jack and two mounting studs.
   2. Manufacturer: Panduit #KWP6PY; Faceplate for wall phone, with modular jack.

C. Faceplate for Open Office Furniture Outlets:
   1. Application: Faceplate shall be compatible with the baseplate and beltway of the selected open office furniture, and shall "snap" into the furniture opening.
   2. Faceplate shall have 4 ports.

3. Manufacturer (example – confirm open office system): Panduit #CFFPL4BL; snap-on faceplate for open office furniture, 4-port.

D. Adapters for Raceway Mount Outlets:
1. Application: Adapter / module insert shall be compatible with the surface raceway opening designated for telecom use. Refer to the Outlet Schedule of the Drawings for additional information. Refer to the electrical drawings for raceway information.
2. Manufacturer: Panduit #CH02MEI-X; module insert for raceway.
3. Color shall match electrical device and/or coverplate.

E. Adapters for Poke-Thru Devices:
1. Application: Adapter / module insert shall be compatible with the poke-thru device. Refer to the Outlet Schedule of the Drawings for additional information. Refer to the electrical Drawings and Specifications for poke-thru device information.
2. Manufacturer: Panduit #CH02MEI-X; module insert for Wiremold "Open Systems" devices.
3. Color shall match electrical device and/or coverplate.

## 2.7 CONNECTORS / MODULAR JACKS

A. Connectors shall be 8-position 8-conductor modular type, shall be CAT6 rated, and shall be intended for the termination of 4-pair UTP cables. Connectors shall be by the same manufacturer as the faceplates.

B. Connectors shall be T568B wired.

C. Manufacturer: Panduit #CJ688TGOR; Mini-Com TX6 Plus Jack Module, Orange.

## 2.8 COURTESY/CAMPUS PHONE

A. Indoor, wall-mount type: Allen Tel #GB306V.

## 2.9 WIRELESS LAN ACCESS POINT ENCLOSURE

A. Indoor ceiling-mount type: Oberon #1055.

B. Indoor wall-mount type: Oberon #1023-00.

## 2.10 LABELS

A. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.

B. Horizontal Cable Labels:
1. Labels shall be adhesive backed and have a self-laminating feature.
2. Labels shall wrap around the cable's jacket.
3. Printable Area: size: 2" x 0.5", minimum; color: white.
4. Manufacturer, or equal: Panduit: #LJSL7-Y3-1; laser/ink jet labels for cable diameters 0.16"-0.32", white.

C. Outlet Faceplate and Port Labels:
1. Labels shall be adhesive backed.
2. Port labels shall fit above the port without overlap to the next port or to the port itself.

3. Manufacturer, or equal: Panduit.
   a. #C125X030FJJ; "Equipment Room Identifier" label, for laser printer.
   b. #C061X030FJJ; "Unique Cable Number" label, for laser printer.

D. Modular Patch Panels:
1. Labels shall be adhesive backed.
2. Labels shall fit above the port without overlap to the next port or to the port itself.
3. Printable Area: size: 0.61" x 0.33", minimum; color: white.
4. Manufacturer, or equal: Panduit. #CPPLF-5; laser labels for modular patch panels, white.

E. 110 Termination Block Labels:
1. Color: Blue for horizontal termination field.
2. Manufacturer, or equal: Panduit #DSL110-BU; label inserts, blue.

## 2.11 MISCELLANEOUS COMPONENTS

A. Velcro Cable Ties:
1. Width: 0.75".
2. Color: Velcro cable ties shall be the same color as the cable to which it is being applied.
3. Manufacturer, or equal: Panduit #HLS-15R-0 Black, 15' roll, cut to length.

# PART 3 - EXECUTION

## 3.1 GENERAL

A. Comply with the Execution requirements of Section 27 00 00.

B. Install products, components, accessories, hardware, etc, according to the manufacturer's instructions.

## 3.2 EXAMINATION

A. Pathways: Prior to installation, verify pathways are complete and ready for cables.

B. Equipment Rooms: Prior to installation, verify equipment rooms are complete and ready for cables.

## 3.3 INSTALLATION

A. Horizontal Cable:
1. General:
   a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
   b. Maintain maximum cable length of 90 meters from the termination in the Telecommunications Room to the termination at the outlet.
   c. A cable bundle shall contain no more than 24 individual cables.
2. Color:
   a. Provide Blue cables for data links.
   b. Provide Gray cables for voice-only links.
3. Installation:
   a. Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
   b. Maintain pulling tension within manufacturer's limits.

c. Protect cable during installation. Replace cable if damaged during installation.
d. Place cables with no kinks, twists, or impact damage to the sheath.
e. Place and suspend cables in a manner to protect them from physical interference or damage.

4. Routing:
   a. When routing horizontally within Telecommunications Room, utilize the overhead cable support. When routing vertically within Telecommunications Room, fasten the cable bundles using approved cable ties to the wall-mounted vertical cable support every 24 inches on center.
   b. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
   c. When routing cables in areas without primary horizontal pathways, install cables onto secondary pathways or approved support devices, such as cable hangers.
   d. Route cables at 90-degree angles, allowing for bending radius along corridors for ease of access. Do not route through an adjacent space if a corridor borders at least one wall of the room.
   e. Provide a 10 feet (minimum) sheathed cable slack loop at each end of the run. In the Telecommunications Room, place the slack in the overhead cable support. At the workstation, place cable in ceiling space before the device conduit stub supported from a cable hanger.
   f. Provide six inches (minimum) of sheathed cable slack behind each workstation outlet faceplate. The slack cable shall be coiled inside the device box, the surface raceway, or within the wall, in accordance with the cabling manufacturer's installation standards.
   g. At the equipment bay in the Telecommunications Room where floor-standing racks are used, divide horizontal cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination. At the equipment bay in the Telecommunications Room where wall-mounted racks are used, route the horizontal cables down the hinged side of the equipment rack.

5. Termination:
   a. Properly (per manufacturer's instructions and TIA/EIA-568-B standard installation practices) strain relieve cables at termination points.
   b. Terminate pairs on the specified connecting hardware. Perform terminations in accordance with manufacturer's instructions and TIA/EIA-568-B standard installation practices.

B. Patch Panels and Horizontal Management Panels:
1. Provide discrete patch panels in a quantity to allow termination of data cables served from respective IDF.
2. Install the discrete patch panels and horizontal management panels in the configuration as shown on the Drawings. Install panels level.

C. Outlet Faceplates:
1. Install faceplates plumb, square, and at the same level as adjacent device faceplates.
2. Patch gaps around faceplates so that faceplate covers the entire opening.
3. For surface raceway, color shall match electrical device and/or coverplate.

D. Outlet Modular Connectors:
1. Terminate pairs on the specified modular connector. Perform terminations in accordance with manufacturer's instructions and TIA/EIA-568-B standard installation practices.
2. Replace terminations and connectors not passing the required media test.

E. Courtesy/ Campus Telephone:
1. Provide backing plate.
2. Install phone unit to height noted in Drawings and per manufacturer's instructions, and in compliance with codes.
3. Obtain extension number from ITS.
4. Provide permanent label on phone unit that displays the telephone's extension.

F. Wireless LAN Access Point Enclosures: Refer to Drawings for enclosure cabling service and installation requirements.

G. Cords and Crossconnects:
1. Refer to Telecommunications Outlet Schedule of the Drawings for cord (workstation, Telecom Room, and other) patching and crossconnecting requirements.
2. Splices in patch cords and crossconnect wire are prohibited.
3. Record crossconnections in IDFs for MDF crossconnection purposes and for record documents.
4. Color:
   a. For digital handsets, provide: White-Blue / Blue-White.
   b. For analog handsets, provide: White-Red / Red-White.

## 3.4 LABELING

A. General Requirements:
1. Labeling, identifier assignment, and label colors shall conform to TIA/EIA-606-A Administration Standard and as approved by Owner's Representative before installation.
2. Labels shall be permanent with machine-generated text; hand-written labels will not be accepted.

B. Label Formats:
1. Horizontal Cable Labels:
   a. Text Attributes:
      1) Black.
      2) 1/8" high, minimum, or #12 font size.
      3) Font: Verdana preferred, or SansSerif or Arial acceptable.
   b. Install labels on both ends of cables no more than 4" from the edge of the cable jacket. Install labels such that they are visible by a technician from a normal stance.
2. Modular Patch Panel Labels:
   a. Use modular patch panel labels included in the product packaging. (Approval by the Owner shall be required for other labels.)
   b. Use a label color for the respective field type, per TIA/EIA-606.
   c. Text Attributes: Black, 3/32" high, minimum, or #10 font size.
3. Outlet Labels:
   a. Text Attributes: Black, 1/8" high, minimum, or #12 font size.
   b. Provide an "Equipment Room Identifier" label at the top of the faceplate with the serving telecommunication room's identifier (refer to 27 11 00 for telecommunication room identifier assignment).
   c. Provide a "Unique Cable Number" label above each port with the link's unique cable number.

C. Identifier Assignment:
1. Horizontal Cables / Cabling Link: Assign each cable a unique number, in ascending order beginning with the number 1.
2. Outlet Ports: The outlet ports shall be identical to the unique cable number.

3. Modular Patch Panel Ports: The modular patch panel ports shall be identical to the unique cable number.

## 3.5 FINAL INSPECTION

A. Inspect installed products and work in conjunction with the Owner. Develop a punchlist for items needing correction.

B. Issue punchlist to the Owner for review prior to performing punchlist walk.

C. Repair defects prior to system acceptance.

D. Inspect installed products and work in conjunction with the Owner for sign off.

**END OF SECTION**

# SECTION 27 51 13

# EVENT ANNUNCIATION SYSTEM – BUILDING DISTRIBUTION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Event annunciation system's building distribution (subsystem of the EAS).

B. Related Sections: Comply with the Related Sections paragraph of Section 27 00 00.

### 1.2 REFENCES

A. Comply with the References requirements of Section 27 00 00.

### 1.3 DEFINITIONS

A. Refer to Section 27 00 00 for Definitions.

B. In addition, the following list of terms as used in this specification shall be defined as follows:
   1. "EAS": Event Annunciation System.
   2. "CL2P": Class 2 Power Listed Circuit Plenum, plenum rating.
   3. "CMP": Communications Media Plenum, plenum rating; synonymous with "MPP."

### 1.4 SYSTEM DESCRIPTION

A. Other System Elements:
   1. SMCCCD intends to use the existing carillon systems at Canada 5 and 6 as the EAS headend.
   2. SMCCCD will provide amplifiers per building in the TDx rooms, where the loudspeaker wiring originates.

B. Base Bid Work:
   1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to complete the building distribution segment of the District's event annunciation system throughout designated spaces within campus buildings, and as described in these specifications.
   2. Consider wiring/cabling and loudspeakers to be base bid work, unless otherwise noted. Amplifiers shall not be base bid work.

C. Loudspeaker Criteria:
   1. Selection Guidelines: The following list offers guidelines for selecting the appropriate loudspeaker type per instance to be noted on shop drawings for approval by the District.
      a. For indoor spaces with lay-in tile suspended ceilings (such as corridors), provide indoor ceiling-mount type loudspeaker.
      b. For indoor spaces with no ceilings (such as stairwells, lobbies, and corridors with no ceilings), provide indoor wall-mount type loudspeaker.
   2. Placement Guidelines: The following list offers guidelines for the installer to locate loudspeakers on shop drawings for approval by the District.
      a. In public corridors, equal to or less than 10 feet wide and 10 feet high, provide loudspeakers spaced approximately 30 feet apart. Attempt to locate loudspeakers near exits and elevators.

b. In stairwells, provide at least one loudspeaker per stairwell located on the middle landing.
c. In vestibules or other areas fully enclosed either in normal conditions or a fire and/or emergency event, provide one loudspeaker per 250 square feet.
d. Do not provide loudspeakers in classrooms (lecture, lab, etc.) and offices.

D. In general, the base bid work includes:
1. Preconstruction Submittals.
2. Cabling/Wiring.
3. Supplemental pathway devices and cable management.
4. Loudspeakers.
5. Cable identification tags and system labeling.
6. Record Documents.
7. Warranty.

## 1.5 SUBMITTALS

A. Comply with the Submittals article of Section 27 00 00 for procedural, quantity, and format requirements.

B. Preconstruction Submittal Requirements:
1. Product Data Submittal, indicating conformance with NEC, UL listings, certifications and specifications.
2. Shop Drawings Submittal, consisting of proposed loudspeaker locations and cable routing.

C. Closeout Submittal Requirements: As-Built Drawings.

## 1.6 QUALITY ASSURANCE

A. Comply with the Quality Assurance requirements of Section 27 00 00.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Delivery, Storage and Handling requirements of Section 27 00 00.

## 1.8 WARRANTY

A. Warrant wiring/cabling and loudspeakers for a period of 2 years. Warranty period shall begin upon SMCCCD's written acceptance of system installation.

# PART 2 - PRODUCTS

## 2.1 SUBSTITUTIONS

A. Comply with the Substitutions requirements of Section 27 00 00.

## 2.2 AUDIO CABLE

A. Application: Suitable for indoor installation within closed ceiling space or open corridors.

B. Wires: Wires shall be 14 AWG stranded copper, fully-insulated with a flame retardant thermoplastic material (PVC, or equivalent), and individually color-coded.

C. Shield: The cable shall have one foil/tape shield fully covering the wires.

D. Outer Jacket: The cable shall be sheathed with a seamless thermoplastic (LS-PVC, or similar) jacket applied to and completely covering the internal components (wires and shield).

E. Flame Rating: NEC (Article 725) rated as CL2P or NEC (Article 800) rated as CMP, and UL listed as such.

F. Manufacturer: Belden #6100FE, or equal.

## 2.3 LOUDSPEAKER – INDOOR CEILING-MOUNT TYPE

A. Suitable for indoor installation within closed ceiling space into corridors.

B. Finish shall be flush with ceiling tile, including trim ring.

C. Manufacturer:
1. Bogen #HFCS1LP, enclosed ceiling-mount loudspeaker.
2. Bogen #TBCR, tile bridge support ring.
3. Bogen #CK10, safety cable kit.

## 2.4 LOUDSPEAKER – INDOOR WALL-MOUNT TYPE

A. Suitable for indoor wall-mount installations, such as stairwells and/or corridors with no ceilings.

B. Manufacturer: Bogen #MB8TSLVR.

## 2.5 LOUDSPEAKER – OUTDOOR SURFACE-MOUNT TYPE

A. Suitable for outdoor installation for open spaces.

B. Loudspeaker shall be horn type.

C. Manufacturer: Bogen #KFLDS30T.

## 2.6 LABELS

A. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.

B. Cable Labels
1. Labels shall be adhesive backed and have a self-laminating feature.
2. Labels shall wrap around the cable's jacket.
3. Printable Area: size: 2" x 0.5", minimum; color: white.
4. Manufacturer: Panduit #LJSL7-Y3-1, or equal.

## 2.7 MISCELLANEOUS MATERIALS

A. Cable Hangers:
1. Application: Suitable for indoor installation within ceiling space for the support of cables.
2. Listings: UL 2043, for use in air handling spaces
3. Manufacturers (or variation per installation method): B-Line #BCH12-W2, or equal

B. Velcro Cable Ties:
1. Width: 0.75".

2. Color: Velcro cable ties shall be the same color as the cable to which it is being applied.
3. Manufacturer, or equal: Panduit: #HLS-15R-0 Black, 15' roll, cut to length.

## PART 3 - EXECUTION

### 3.1 GENERAL

A. Comply with the Execution requirements of Section 27 00 00.

B. Install products, components, accessories, hardware, etc, according to local, state, and federal codes, and per the manufacturer's instructions.

### 3.2 EXAMINATION

A. Pathways: Prior to installation, verify route and capacity of existing pathways, and ready for new cables.

### 3.3 INSTALLATION

A. Loudspeaker – Indoor Ceiling-Mount Instances:
1. Cut ceiling tile such that no visible cuts and/or openings are visible after installation of loudspeaker and trim.
2. Provide one bridge support ring per loudspeaker spanning the "T-bar" of the suspended ceiling system.
3. Provide one safety cable per loudspeaker attached to building structure for seismic bracing. Provide accessories, such as power-actuated masonry fasteners, to attach safety cable to structure.
   a. Obtain written approval from SMCCCD of fastening component prior to installation.

B. Loudspeaker – Indoor Wall-Mount Instances:
1. Coordinate the loudspeaker's installation location with cable route to minimize the route of surface-mounted raceway and cable (minimize the length of 'exposed' raceway and cable).
2. Locate loudspeaker at least 8 feet 6 inches above finished floor in public spaces such as corridors. Locate loudspeakers at lease 6 inches from nearest obstruction (soffit, duct, etc.).
3. No loudspeaker shall block visibility to an exit sign. The Contractor shall relocate loudspeakers at SMCCCD's discretion should the installed conditions potentially violate code.
4. Attach loudspeaker to surface using fasteners appropriate for the substrate; for example, provide masonry fasteners (screws such as Tap-Con) for concrete walls.

C. Pathways:
1. Utilize existing pathways to the maximum possible extent.
2. Where necessary, provide supplemental pathways devices such as cable hangers.
3. Where cables route on exposed walls, provide metallic surface raceway. Attach raceway to surface using fasteners appropriate for the substrate; for example, provide masonry screws for concrete walls.

D. Loudspeaker Cable:
1. General:
   a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.

b. Provide at least one cable run per floor. If the building's layout/floor plan will not allow a single run per floor in a logical manner, then provide two runs on that floor(s).
c. Connect the audio cable to the loudspeakers in a parallel wiring configuration.

2. Installation:
   a. Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
   b. Maintain pulling tension within manufacturer's limits.
   c. Protect cable during installation. Replace cable if damaged during installation.
   d. Place cables with no kinks, twists, or impact damage to the sheath.
   e. Place and suspend cables in a manner to protect them from physical interference or damage.
   f. Place cables onto/into pathways or approved support devices, such as cable hangers. Do not strap and/or cable tie cables to the outside of existing pathways (which is a code violation) and to ceiling support wires.
3. Routing:
   a. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
   b. Route cables at 90-degree angles, allowing for bending radius along corridors for ease of access. Do not route through an adjacent space if a corridor borders at least one wall of the room.
   c. Within Telecommunications Rooms:
      1) Routing horizontally, utilize the overhead cable support.
      2) Routing vertically, fasten the cable bundles using approved cable ties to the wall-mounted vertical cable support every 24 inches on center.
   d. Provide a 10 feet (minimum) sheathed cable slack loop at the telecommunication room end of the run (for future termination).

## 3.4 LABELING

A. Labels shall be permanent with machine-generated text; hand-written labels will not be accepted.

B. Text Attributes:
   1. Black.
   2. 1/8" high, minimum, or #12 font size.
   3. Font: Verdana preferred; SansSerif or Arial acceptable.

C. Install labels on both ends of cables no more than 4" from the edge of the cable jacket. Install labels such that they are visible by a technician from a normal stance.

D. Label Content: Labels shall display the building and floor, and (if applicable) the run number.

## 3.5 FINAL INSPECTION

A. Inspect installed products and work in conjunction with SMCCCD. Develop a punch list for items needing correction.

B. Issue punch list to the SMCCCD for review prior to SMCCCD performing their punch walk.

C. Repair defects prior to system acceptance.

D. Inspect installed products and work in conjunction with SMCCCD for sign off.

**END OF SECTION**

# SECTION 27 53 13

# CENTRAL CLOCK SYSTEM

## PART 1 - GENERAL

### 1.1 SUMMARY

A. General: The district utilizes a Simplex central clock system that provides synchronized timepieces throughout its three colleges and the district administration building. Provide, labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to complete a working Central Clock system installation, as described in these specifications.

B. Section Includes:
1. Central clock system controller Simplex 6351 Time controller center.
2. Secondary field clocks (Simplex #6310-9231) capable of connecting to a SIMPLEX 6351 Master Clock System.
3. Secondary clock cable requirements.

C. Products Specified But Not Installed Under This Section: Secondary clock single gang back boxes with 3/4" conduit to accessible ceiling space.

D. Related Sections:
1. Comply with related section paragraphs of section 27 00 00 Telecommunications Basic Requirements.
2. Comply with related section paragraphs of section 27 13 10 Telecommunications backbone ISP cabling.
3. Comply with related section paragraphs of section 27 13 14 Telecommunications backbone OSP cabling.
4. Comply with related section paragraphs of section 27 15 13 Telecommunications horizontal cabling.
5. Comply with related section paragraphs of section 26 01 00 Basic materials and methods.

### 1.2 SYSTEM DESCRIPTION

A. Overview: Central clock system will provide a centrally located clock controller to maintain accurate time and adjustment to secondary clocks located in classrooms, offices and administration areas throughout the campus distribution system.

### 1.3 SUBMITTALS

A. Contractor Qualifications: Submit certification letters for District clock manufacturer "Simplex".

B. Product Data: Submit product information for components specified herein. Refer to Section 280000 for format and requirements.

C. Shop Drawings: Submit shop drawings in accordance with Division 1. Refer to Section 280000 for format and requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Centralized clock system: Use Simplex model 6351 Synchronized Time Controller Center for head-end equipment.
   1. Must be Microprocessor based.
   2. Must have RS-232 interface for synchronization to external time source.
   3. Must have automatic Daylight Saving Time correction.
   4. Must have 12 or 24 hour, 6-digits liquid crystal time display.
   5. Must have 60 day battery standby.
   6. Complies with UL Standards 863.

B. Secondary Clocks: Use Simplex model 6310-9231 for secondary surface mounted clocks or equal.
   1. 12" diameter round black frame.
   2. Black Arabic numerals.
   3. Use a continuous sweeping second hand.
   4. Surface mounted on the wall.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Centralized Controller Equipment Installation:
   1. Coordinate installation of equipment with other trades to avoid unforeseen conflict in Equipment Room.
   2. Properly bond system to Main Telecommunication Ground Bussbar.
   3. Mount unit above 48" AFF to accommodate service and maintenance.

B. Secondary Field Clocks:
   1. Provide single gang back box with 3/4" conduit to accessible ceiling space at 96" AFF (provided by electrical contractor).
   2. Route connection cable to single gang back box.
   3. Install clock making connection to cable in single gang back box.

**END OF SECTION**

# SECTION 28 31 00

# FIRE DETECTION AND ALARM SYSTEM

## PART 1 - GENERAL

### 1.1 SCOPE

A. This Section describes a Protected Premises Fire Detection system for the following San Mateo County Community College District sites: Cañada College, College of San Mateo and Skyline College. Modifications to the existing fire alarm system shall provide evacuation alarm tone signaling using horns to sound the alarm signals and ADA-compliant strobe notification devices for visual notification. The system shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The system provided shall have a Fire Alarm Control Panel (FACP) and field devices as indicated on the DSA-approved drawings.

B. The features and capacities described in this specification are a requirement for this project and shall be furnished by the successful contractor. The District has determined that the Siemens MXL system, provided by Siemens Building Technologies, Hayward, CA (contact Kelly Rogers: 510-783-6000), is the District standard, no equal. The system as described in this specification and as shown on the drawings shall be installed, programmed, tested, and delivered to the owner in fully operational condition. The system shall include all required hardware, software, raceways and interconnecting wiring to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein. The system shall consist of, but not be limited to, the following:
   1. Fire Alarm Control Panel (FACP).
   2. Fire Alarm Remote Annunciator (FAAP).
   3. Booster Power Supplies.
   4. Addressable Manual Fire Alarm Pull Stations.
   5. Addressable Analog Smoke Detectors.
   6. Addressable Area Heat Detectors.
   7. Addressable Analog Duct Smoke Detectors.
   8. Addressable Intelligent Interface Modules.
   9. Audible and Visual Notification Appliances.

C. Non-addressable alarm initiating, supervisory and status monitored devices shall be integrated into the fire alarm system, as applicable, via an addressable intelligent interface module, as indicated on the drawings:

D. Sprinkler Water Flow Alarm (alarm initiating):
   1. Sprinkler Valve Tamper Switch (supervisory).
   2. PIV, OS&Y.
   3. Kitchen Ansul Systems.
   4. Security Interface.
   5. Magnetic hold-opens.

E. Connections to existing elevator control panels (by others) and providing the necessary modules for elevator recall and shunt trip functionality.

F. Audible/visual notification appliances and communicating devices to be controlled by the FACP:
   1. Horns.
   2. Strobe Lights.
   3. Combination Horn/Strobes.

G. Connect system to the existing campus MXL network system such that all status changes are transmitted to the Main Campus FACP.

H. DSA and local requirements shall be adhered to with regard to submitting specifications, wiring diagrams, shop drawings and plans. Responsibility for furnishing the quantities of copies in digital format and/or hard copy, as directed by contract requirements, shall be included as part of the work of this section.

## 1.2 RELATED SECTIONS, RELATED WORK AND EXISTING CONDITIONS

A. RELATED WORK:
1. The contractor shall coordinate work described within this section with all related trades and shall relay all necessary coordination information to the System Supplier in a timely manner such that proper coordination shall take place. Work and/or equipment provided in other sections and related to the fire alarm system shall include, but not be limited to:
   a. Mechanical Coordination: Sprinkler water flow alarm and valve tamper switches to be provided and installed by the fire protection sprinkler contractor, if a part of this project. See Division 21. They shall be wired and connected to the fire alarm system monitor modules by the contractor.
   b. Mechanical Coordination: Duct Smoke Detectors shall be provided and wired under this Section and installed under the mechanical section as shown on the fire alarm system drawings.
   c. Security Interface, if required.
   d. Coordinate with all other trade contractors for the mounting of and/or interfacing with any and all other fire alarm system related devices.

B. EXISTING CONDITIONS:
1. This project consists of modifying the existing fire alarm system within the existing building. The contractor shall visit the site to determine and verify all existing conditions. Existing conditions that would, in the contractor's opinion, prohibit or greatly delay construction progress shall be brought to the Architect and Engineer's attention in writing in a timely manner.
2. No additional compensation shall be permitted for variations due to accessible field conditions that would affect the installation of the fire alarm system.

## 1.3 REFERENCES - APPLICABLE LISTINGS, CODES, STANDARDS, DOCUMENTS

A. STANDARDS AND CODES:
1. All equipment shall be installed and comply with the current adopted provisions of the following codes and standards.
2. All equipment shall be Underwriters' Laboratories (UL), Inc. listed for its intended use. At a minimum, the following standards shall apply:
   a. UL 268 and 268A - Smoke Detectors for Fire Protective Signaling Systems.
   b. UL 346 – Water-Flow Indicators for Fire Protective Signaling Systems.
   c. UL 464 - Audible Signaling Appliances.
   d. UL 864 - Control Units for Fire Protective Signaling Systems.
   e. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
   f. UL 1971 - Signaling Devices for the Hearing-Impaired.
3. National Fire Protection Association (NFPA) standards:
   a. NFPA No. 13 - 1999 Edition - Sprinkler Alarm and Supervision.
   b. NFPA No. 70 National Electrical Code.
   c. NFPA No. 72 National Fire Alarm Code.
   d. NFPA No. 90A Installation of Air Conditioning & Ventilating Systems.
   e. NFPA No. 101 Life Safety Code.
4. All raceways and wiring shall be installed in compliance with NFPA Standard 70

(National Electrical Code - Article 760) with applicable California amendments. Codes shall be implicitly followed, in particular, with regard to material type and quality, circuitry extensions from and connections to outlet and junction boxes, panel boards and similar appurtenances.

5. The fire alarm system and its installation shall comply with all applicable requirements of the Americans with Disabilities Act of 1992.
6. The fire alarm system and its installation shall comply with DSA and all other local codes and authorities having jurisdiction, including but not limited to, San Mateo County Community College District's engineering design standards and guidelines.

## 1.4 SYSTEM DESCRIPTION

A. The system shall operate as an integrated, multiplexed, protected premises fire alarm control system tied into the existing campus network system.

B. Changes in the status of monitored points shall be detected by the microprocessor based fire alarm control panel and shall report any change in status to the Main Campus Fire Alarm System utilizing master-slave (Cañada College) networking protocol.

C. Sensor "dirty" and "excessively dirty" trouble conditions shall report automatically.

D. Devices shall be listed by UL for sensitivity testing by means of the portable programmer/tester or by readout from the control panel. Each addressable device address shall be set electronically, devices requiring dipswitch settings, rotary switch settings, staples or jumper settings are not acceptable.

E. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.

F. System shall individually identify each addressable initiating device and other addressable monitor functions using multiplexing interfacing techniques.

G. System shall be capable of operating alarm notification appliances, and other control functions, using multiplexing techniques.

H. Life safety alarm function programs shall perform automatically upon system alarm actuation. In addition, control points may be operated manually at any time by the attendant through appropriate keyboard commands. The FACP shall also provide integral programmable function control switches to allow personnel to manually operate specific pre-programmed control output functions, as required.

## 1.5 QUALITY ASSURANCE

A. It is the intent of these specifications to provide a complete fire alarm system that complies in all respects with the requirements of all applicable codes and standards. Equipment, materials, software, installation practices, etc. that do not meet these requirements or do not meet the performance standards herein specified shall not be acceptable.

B. The equipment furnished under this specification shall be that of the specified manufacturer, no equal. All information herein is intended to establish minimum standards of performance, quality and construction, and is based upon the Siemens MXL addressable analog equipment designed and manufactured by Siemens Building Technologies, Inc. Catalog and model numbers are specified herein and indicate the materials as well as the operating features required. It is not the intent of these specifications to eliminate competitive installation proposals, only to standardize the District's Fire Life Safety Systems.

C. Before commencing work the fire protection contractor shall submit data showing that contractor has successfully installed fire alarm systems of the same scope, type and design as specified. The contractor shall also include the names and locations of at least three installations where such systems have performed satisfactorily for the preceding 18 months.

1. The contractor shall submit copies of all required Licenses and Bonds as required by the State.
2. The system supplier shall employ on staff a minimum of one NICET level 4 personnel or a professional engineer, registered in the State of California.
3. Installing contractors unable to comply with the provisions of Article 1.6 shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

D. Provide the services of a representative or technician from Siemens Building Technologies. The representative or technician is to be certified and experienced in the installation and operation of the type of system specified. The representative shall be licensed in the State, if required by law. The fire alarm contractor shall supervise installation (duct detector locations are to be determined by the mechanical contractor). The system supplier shall provide all software programming, software documentation, system adjustments, preliminary testing, final testing and certification of the system. The fire alarm supplier shall also be required to provide a 4 hour operational instruction to the owner's personnel.

E. All fire alarm system equipment furnished under this specification shall be UL listed, under the appropriate category, as the product of a single manufacturer. All control equipment shall be listed under UL as a single control unit. The manufacturer shall have been engaged in the production of this type of equipment for at least ten (10) years and have a fully equipped service organization capable of responding within 48 hours from the initial contact for warranty or regular service work. Emergency and/or off hours calls shall be responded to within 4 hours of initial contact, seven days a week.

F. Prior to bid submittal, contractor shall state what, if any, specific points of the proposed system's operation or the equipment's quality differ in any way from this specification by submission of a complete technical proposal to include supporting literature and drawings. Only those departures from these specifications shall be considered by the engineer. Failure to submit all departures from these specifications and to receive approval for such departures, shall be cause for summary rejection of any submittal documents where unapproved departures are discovered.

G. Should conflicts arise between project drawings and/or these specifications, regarding design, quantities of devices or circuits, the higher standard and/or quantity and/or cost shall be considered correct.

H. It is the contractor's responsibility to submit acceptable equipment for review by the engineer. The contractor shall bear all liability for damages arising from his failure to submit equipment that meets these specifications, including, but not limited to, any penalties for failure to meet construction deadline.

I. Final determination of compliance with these specifications shall rest with the Engineer of Record, who, at its discretion, may require proof of performance at the cost of the contractor. Required proof may include, but shall not be limited to, expense paid visits by representatives of the owner and engineer to sites where identical equipment is installed and providing beneficial use.

## 1.6 SUBMITTAL REQUIREMENTS

A. Prior to the start of work, the contractor shall provide a complete and comprehensive submittal for review by the engineer. These are to describe the proposed system and its equipment. Failure to provide a complete submittal shall be grounds for summary rejection of any incomplete submittal documentation. District reserves the right to deduct monies from payments due Contractor to cover District and Architect/Engineer's additional costs of review beyond the second submission. The complete submittal shall include, but not be limited to, all of the following material:

1. Power Calculations:
   a. Battery capacity calculations shall be a minimum of 125% of the calculated requirement.
   b. Supervisory power requirements for all equipment.
   c. Alarm power requirements for all equipment.
   d. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst case condition plus 25% spare capacity.
   e. Voltage-drop calculations for wiring runs demonstrating worst-case condition.
2. Complete manufacturers catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
3. Complete drawings covering the following shall be submitted by the contractor for the proposed system. Floor plans in the current AutoCAD version showing the locations of all equipment and raceways, conductor counts with type and size.
4. A complete proposed system database including a description of all logic strings, control by event programming and point identification labels on a unique CD-ROM and in a formatted printed form, as required for off site editing, shall be submitted for evaluation by the owner: The program shall include all required interactive control functions between the local network systems and the methods for implementing these actions.
5. Provide the address, telephone number, and contact person(s) of the manufacturer's local service facility for normal and off-hour warranty issues.
6. Provide a fire alarm system function matrix. Matrix shall illustrate alarm output events in association with initiating devices input events. Matrix shall represent a summary of the installed system alarm, supervisory and trouble functions. (See Appendix-A NFPA-72 for minimum matrix requirements - A-7-5.2.2 (9) 1999).
7. For each system control and/or power panel, provide panel ampere loading during both normal and alarm modes, with time calculations to substantiate compliance with battery back-up power requirements (battery Ampere-Hour capacity), described elsewhere in these specifications.
8. For each system control panel, provide written schedule of active and spare addresses provided on each addressable circuit to substantiate compliance with circuit usage/spare requirements, described elsewhere in these specifications.
9. For each system control panel and system transponder notification appliance circuit, provide proof of spare capability in amperes available for future use, if needed.
10. Provide manufacture's printed product data, catalog pages and descriptions of any special installation requirements and/or procedures. Drawings depicting any special physical installation requirements shall show physical plans, elevations, all dimensions, conduit entry, minimum access clearances and any other details required.
    a. Provide shop drawings as follows:

b. Drawing or catalog page showing actual dimensions of the main FACP.
c. Drawing(s) or catalog page(s) showing actual dimensions of any additional system control panels and/or battery cabinets.
d. Drawing or catalog page showing actual dimensions of the Remote Annunciator.
e. Single line riser diagram showing, all equipment, all connections and number and size of all conductors and conduits.
f. Provide samples of various items when so requested by the Architect/Engineer.

B. A maximum of two submittal reviews will be performed by Engineer. Compensate additional time and material to the Engineer based on their published fees for additional reviews.

## 1.6 WARRANTY

A. Section 01 77 00 – Contract Closeout: Requirements for warranties.

B. WARRANTY/SERVICES: The contractor shall warrant the entire system against system hardware and electrical defects including programming software defects for a period of one year. This period shall begin upon Substantial Completion of the project by the Architect of Record/Engineer of Record, but not prior to certification of final acceptance testing of the system. Contractor shall provide to owner a letter stating the start-date and end-date of warranty period. In addition, the contractor shall also provide an updated list of name(s) and phone number(s) for normal and off-hours contacts necessary to respond to warranty issues. Response to warranty notification shall require a reply within 24 hours of initial contact.

# PART 2 - PRODUCTS

## 2.1 BASIC SYSTEM EQUIPMENT, CIRCUITING, ADDRESSING AND OPERATING CAPABILITIES

A. GENERAL:
1. The FACP shall communicate via an RS-485 Carrier Sense, Multiple Access, Collision Detect protocol, also known as CSMA/CD or an ETHERNET type topology.
2. The FACP shall provide NFPA 72, Style 4 (Class B) analog signaling line circuits. Each loop card shall communicate with and receive alarms from up to 120 points, consisting of a maximum of sixty intelligent analog alarm initiating and sixty intelligent controllable output devices. Circuits shall be configured with loop isolators and wired in a manner that prevents a catastrophic wiring event on a floor from affecting the performance of other floors.
3. Remote Annunciator (Siemens RCC Series): LCD type with two lines of 40 characters each. The Remote Annunciator shall communicate to the FACP on one #16 TSP and derive power from the FACP over a pair of #14 AWG conductors. It shall be possible to Acknowledge general "ALARM", "TROUBLE", and "SUPERVISORY" conditions from the Remote Annunciator using a key. Each Remote Annunciator must be housed in a lockable box. NEMA rated boxes are required for any locations, interior or exterior, where adverse weather or high humidity conditions occur. Mount Remote Annunciator(s) as indicated on the drawings, at a height where reasonable viewing is possible by the responding fire authority. Obtain approval of the specific location from the Architect and/or Engineer of Record prior to mounting the Annunciator.
4. System power supplies, including necessary Booster Power Supplies, transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all

devices in alarm and all local indicating appliances active without exceeding the listed ratings. Provide adequate notification appliance Booster Power Supplies so as to allow for a minimum of 20% spare capacity on each NAC.

a. System primary power: Primary power for the FACP and the secondary power battery chargers shall be obtained from a dedicated emergency power circuit. Circuit breakers shall be fitted with a suitable guard, requiring removal of a screw to open, and used only for fire alarm. Each circuit used for fire alarm purposes shall be permanently labeled for function.

b. Secondary power supply: Provide sealed gelled electrolyte batteries as the secondary power supply for all fire alarm functions. The battery supply shall be calculated to operate loads in a supervisory mode for twenty-four (24) hours no primary power applied and after that time, operate in alarm mode for five (5) minutes. Batteries shall be sized at 125% of the calculated size to compensate for deterioration and aging during the battery life cycle. Battery calculations shall be submitted to justify the battery size.

5. The system 16 bit core processor shall incorporate an internal operating system to process incoming alarm signals and issue output commands required as a result of the alarm reception, by system programming or by manual commands. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with single watchdog circuits for all processors shall not be acceptable unless supplied with a "hot" standby CPU. Digital communication capabilities required for the control panel to communicate with remote annunciators, input/output drivers and displays shall be provided.

6. Manual Addressable Pull Stations (Siemens MSI-10B) shall be the single action type, unless specifically noted otherwise by these specifications or on project drawings, and listed by Underwriters' Laboratories, Inc. The intelligent manual fire station shall operate on any addressable detection circuit. It shall be red in color. Manual fire stations shall be individually annunciated on the control panel. Mounting height shall be 48" inches to the manual station actuation handle from the finished floor.

7. Intelligent/analog smoke detectors (Siemens FP-11) shall be photoelectric and listed by Underwriters' Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be compensating for detector aging and dirt accumulation. The smoke detector shall be a plug-in twist/lock unit that allows for easy connection to its mounting base. Each smoke detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode. Application Specific Detection environmental settings shall be programmed as directed by the engineer. System programming shall provide multiple output functions from a single initiating multi-criteria smoke detector. This capability shall mean a separate alarm event output for smoke alarm and a separate alarm output function for thermal alarm from a single analog initiating address device. Systems not capable of providing this design requirement shall provide alternate programmable logic accomplishing design performance, acceptable to the Engineer of Record.

   a. It shall be possible to adjust and/or electronically measure the sensitivity of each individual intelligent analog smoke sensor from the control panel. Relative sensitivity or manual test methods, which check the smoke sensor at the maximum allowable obscuration, will not be considered as being equivalent.

   b. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.

8. Intelligent/Analog Duct Smoke Detector (Siemens FP-11/AD2-XHR, or ILP-1/AD-

3ILP for rooftop applications) shall be photoelectric and listed by Underwriters' Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be compensating for detector aging and dirt accumulation. The smoke detector shall be a plug-in twist/lock unit that allows for easy connection to its mounting base. Each smoke detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode. Application Specific Detection environmental settings shall be programmed as directed by the Engineer. System programming shall provide multiple out-put functions from a single initiating multi-criteria smoke detector. This capability shall mean a separate alarm event output for smoke alarm and a separate alarm output function for thermal alarm from a single analog initiating address device. Systems not capable of providing this design requirement shall provide alternate programmable logic accomplishing design performance, acceptable to the Engineer of Record.

a. It shall be possible to adjust and/or electronically measure the sensitivity of each individual intelligent analog smoke sensor from the control panel. Relative sensitivity or manual test methods, which check the smoke sensor at the maximum allowable obscuration, will not be considered as being equivalent.
b. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.
c. Coordinate sampling tube sizing with mechanical ducting requirements prior to shipping.

9. Heat detectors (Siemens FPT-11) shall be 135° F fixed temperature or fixed temperature/rate of rise and be listed by Underwriters' Laboratories, Inc. Rate-of-rise alarm threshold rate shall be 15° F per minute with a maximum coverage area of 2,500 sq. ft. Activation of the rate-of-rise heat detector shall be self-restoring. All detectors shall be addressable and have a white finish. The thermal detectors shall be individually annunciated on the control panel. Each heat detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode.
10. High temperature heat detectors (Siemens DT-200R) shall be conventional 200° R fixed temperature/rate compensated and listed by Underwriters' Laboratories, Inc. The detector shall have a maximum coverage area of 2,500 sq. ft. Upon activation, the detector shall latch in alarm until reset at the main fire control panel and be self-restoring. The detector shall be individually annunciated at the control panel by means of interfacing with a remote addressable monitor module (TRI Series) or an addressable conventional zone module (CZM-4). The detector's interface module address shall be set by electronic means only, no mechanical means such as programming pins, dip-switches or rotary dials shall be used.
11. Interface modules (Siemens TRI Series) shall be intelligent and listed by Underwriters' Laboratories, Inc. The unit shall incorporate a custom microprocessor based integrated circuit that provides communication with main fire control panel. The interface module shall supervise and monitor normally open or normally closed dry contacts and report their status to the control panel. The intelligent interface module shall be used to uniquely identify field devices (contacts) such as kitchen Ansul, suppression system, water flow switches, tamper switches, OS&Y valves or as directed by these specifications and project drawings.
12. Intelligent interface modules (TRI-R) shall also be used when remote relays are required for system control functions, such as, but not limited to, fan shut down, door holder trip and elevator recall and shunt trip functions. Relay dry contacts

shall be rated at 4 AMPS, 120 VAC resistive or 30 VDC resistive and contacts shall be Form "C" type.

13. The MXL and Booster Power Supplies shall provide NFPA 72, Style Y, two-wire (Class B), notification appliance circuits.
14. Horns (Wheelock AH Series) shall be installed as shown on the drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Provide UL listed weatherproof units and their required back boxes where shown on the drawings.
15. Horn Strobes (Wheelock Z-Series) shall be installed as shown on the drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Provide UL listed weatherproof units and their required back boxes where shown on the drawings. See Strobe requirements below.
16. Strobes (Wheelock Z-Series) shall be installed as shown on the drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Where multiple visual notification appliances can be seen from any location, circuitry shall be incorporated for the synchronization of flash rate. Strobes shall be of the latest compatible Siemens appliances. See DSA approved drawings for device quantities and locations. Provide UL listed weatherproof units and their required back boxes where shown on the drawings.
    a. Strobes shall produce a flash rate of one (1) flash per second minimum over the listed input voltage (20VDC - 31VDC) range.
    b. Strobes shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry.
    c. Strobe intensity shall be rated per UL 1971 for 15/75, 30/75, 60/75, 75 or 110 Candela. Dual listing strobes of 15/75 intensity for UL 1971/near-axis requirements shall be used where acceptable.
    d. Strobes shall be available for semi-flush or surface mounting and in conjunction with audible appliances as required.
17. Magnetic Door Hold-Opens (Rixen FM-998) shall be of the wall mount type and capable of operating at three voltages, 120VAC, 24VDC AND 24VAC, shall be provided under this section. They shall operate using local 24VDC power. The power shall be intercepted by a fire alarm system addressable control module or a relay base detector in order to interrupt the circuit so that the door closes in a fail-safe manner. See DSA approved drawings for device quantities and locations.
18. Software and firmware control:
    a. All software and firmware provided with a fire alarm system shall be listed for use with the fire alarm control unit.
    b. A record of installed software and firmware version numbers shall be maintained at the location of the fire alarm control unit.
    c. All software and firmware shall be protected from unauthorized changes through the use of "access levels."

B. SYSTEM ALARM OPERATION:

1. Activation of any addressable manual fire pull box, area smoke detector, heat detector or waterflow switch shall result in, at a minimum, the following functions and indications:
    a. Activate "ALARM" status change at the local FACP and annunciate on its LCD display, indicating device address, device type, device location, time and date.
    b. Indicate "ALARM" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date.
    c. Activate General "ALARM" status change at the Off-Site Monitoring Station, through the Campus Network System.
    d. Activate emergency evacuation audible and visual notification appliances within the associated building(s).
    e. Annunciate "ALARM" status change at the On-site Main Campus Fire

Alarm Control Panel location.
f. Record event in the non-volatile system historical log.
g. Record event system status change on the Main Campus Printer.

2. Elevator Recall:
   a. Activation of smoke detector in an Elevator Lobby (other than the Lobby designated "Primary Recall Floor) Machine Room or Elevator Shaft shall cause the associated elevator(s) to be recalled to the designated Primary Recall Floor.
   b. Activation of the Lobby Smoke detector on the designated Primary Recall Floor shall cause the associated elevators to be recalled to the designated Secondary Recall Floor.
   c. Activation of any Elevator Machine Room heat detector shall shunt trip the respective elevator main breaker.

C. SYSTEM SUPERVISORY FUNCTIONS:
1. Activation of any Supervisory circuit, (i.e.; duct detector, supervised fire sprinkler valve closure, fire suppression system air pressure abnormal, low temperature, fire pump trouble, emergency fuel tank level alarm, as applicable to this project), shall cause the following actions and indications:
   a. Activate "SUPERVISORY" status change at the FACP and annunciate on its LCD display, indicating device address, device type, device location, time and date.
   b. Indicate "SUPERVISORY" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date.
   c. Activate General "SUPERVISORY" status change at the Off-Site Monitoring Station, through the Campus Network System.
   d. Annunciate "SUPERVISORY" status change at the On-site Main Campus Fire Alarm Control Panel location.
   e. Record event in the non-volatile system historical log.
   f. Record event system status change on the Main Campus Printer location.

D. SYSTEM TROUBLE FUNCTIONS:
1. Receipt of a system trouble alarm, shall cause the following actions and indications:
   a. Activate "TROUBLE" status change at the FACP and annunciate on its LCD display, indicating device address, device type, device location, time and date.
   b. Indicate "TROUBLE" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date.
   c. Activate General "TROUBLE" status change at the Off-Site Monitoring Station, through the Campus Network System.
   d. Annunciate "TROUBLE" status change at the On-site Main Campus Fire Alarm Control Panel location.
   e. Record event in the non-volatile system historical log.
   f. Record event system status change on the Main Campus Printer location.
2. The fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the FACP.
3. System addressable devices shall be supervised for placement and normal operation. Removal of an addressable device or the failure of its internal electronic circuitry shall initiate a system trouble condition.
4. The FACP shall initiate a system trouble condition when the following occurs:
   a. Primary 120/220 VAC power loss.
   b. Battery disconnect.
   c. Battery low voltage.

d. LCD annunciator panel power loss.

5. Operating an Off-Site Station agency alarm disconnect switch or any manual control commands that alter the system from its normal programmed standby configuration shall initiate a trouble condition.
6. Trouble conditions shall automatically activate an audible signal and flash the general system trouble LED indicator at the FACP. Pressing the trouble acknowledge key on the FACP shall silence the audible signal and continuously light the LED indicator, until the trouble condition is repaired. Subsequent trouble conditions shall re-sound the audible signal and again flash the LED. Each trouble condition must be individually acknowledged.
7. Removal of or failure of internal electronic circuitry of any addressable device shall initiate a system trouble condition.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. INSTALLATION SHOP/AS-BUILT DRAWINGS:

1. Show general layout of complete system including equipment arrangement. It shall be the responsibility of the fire alarm installing contractor to verify dimensions and ensure compatibility of all system interfaces. Shop drawings shall be maintained at the job site and shall be updated on an as needed basis. During the project life cycle, the Architect/Engineer may require updated drawings as reference during scheduled project meetings: Identify on the drawings, conduit and conductor sizes and types with number of conductors in each conduit. Provide each conduit and device with a unique identification. For addressable alarm initiation devices, the system identifier shall be the system address for that device. Signals shall be sequentially numbered with the address of the associated control module.
2. As-built drawings shall indicate point to point wiring diagrams of interconnecting wiring within all system control panels and termination enclosures showing wiring between modules and connecting field device terminals. All field numbering and/or labeling shall be reflected on As-built drawings.
3. Provide mounting details of FACP, remote transponder control panels (if any), system terminal enclosures and other boxes to building structure, showing fastener type, sizes, material and embedded depth.

B. CONDUIT, BOXES, ENCLOSURES AND WIRING DEVICES:

1. All system wiring shall be in conduit and shall comply with all applicable article of the current California-amended NEC edition.
2. Boxes shall be installed plumb and firmly in position.
3. Extension rings with blank covers shall be installed on junction boxes where required.
4. Junction boxes served by concealed conduit shall be flush mounted.
5. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
6. All junction boxes shall be painted fire department red and be affixed with a decal or silk-screened label "Fire Alarm System."
7. Wet or damp locations shall require a NEMA rated enclosure suitable for the environment in which an addressable field device or module are to be installed (i.e. monitoring of sprinkler water flow, tamper switches and OS&Y valves).
8. Electrical conduits shall enter only at the side or the bottom of control cabinets, unless designed and approved for entry on the top.
9. All conduits shall be grounded to a water main by approved ground clamps with a conductor equal in size to the largest conductor used in the system; but in no case shall the ground conductor be smaller than no. 10 AWG.

10. All openings in fire rated walls, floors or ceilings where conduits, cables or wiring trays pass through shall be fire stopped with an approved fireproofing material rated to meet or exceed the rating of the assembly penetrated.

C. CONDUCTORS:

1. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
2. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer-wiring guides.
3. Wiring for analog loop circuits, conventional detection circuits, speaker circuits and telephone circuits shall based on the fire alarm manufactures wiring guidelines, but shall not be smaller than #16 AWG.
4. Notification Device Circuits: Minimum wire size shall be 12 AWG for horn and strobe circuits.
5. Splices shall be made with UL listed mechanical connectors to assure reliable service.
6. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
7. Wire nuts or other solderless splicing devices shall not be used.
8. A consistent color code for fire alarm system conductors throughout the installation shall be provided. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.
9. All nominal voltage branch circuit power feeds (120/220 VAC) shall be identified "labeled" at both ends of the circuit to indicate its source and purpose. Each FACP and control panels shall have a dedicated branch circuit with shunt trip disconnect, labeled as such.
10. Wiring within system control panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance and to isolate nominal voltage wiring from system low voltage wiring.

D. DEVICE DESCRIPTORS:

1. Descriptors at SMCCCD MXL panels shall be developed following this standard SMCCCD protocol. No exceptions are allowed.
   a. Address, Device, Equipment ID (if needed), Building Number, Floor Number, Description
2. Devices shall be identified by an abbreviation or code from the following table below.

| **Initiating Devices** | | | **Communication Devices** | |
|---|---|---|---|---|
| Smoke Detector | SD | | Fireman's Phone | FP |
| Heat Detector | HD | | Fireman's Jack | FJ |
| Duct Detector | DD | | | |
| Beam Detector | BD | | **Panels** | |
| Air Sampling | AS | | Fire Alarm Control Panel | FACP |
| Monitoring Device (By Name) | MSC | | Printer | PRT |
| Pull Station | PS | | Annunciator | ANN |
| Tamper Switch | TS | | Video Display Terminal | VDT |
| Water Flow | WF | | Voice Evac Panel | EVAC |
| Fire Smoke Damper | FSD | | Fan Control Panel | FAN |
| | | | Network Control Center | NCC |
| **Notification Devices** | | | Aux Power Supply | PWR |

| | | | | |
|---|---|---|---|---|
| Audible | AUD | | Dialer | DIAL |
| Visual | VIS | | Foreign System Interface | FSI |
| Audible/Visual | AV | | | |
| Voice Evac Speaker | SPKR | | | |

3. If the device is monitoring or controlling a piece of equipment, then that equipment's ID shall immediately follow the Device. (e.g., TRI HV-5A).
4. If the description is to contain a single compass point, it should be spelled out (e.g., North). If the description uses multiple compass points such as North East it should be abbreviated (e.g., N.E.).
5. If the description contains a room number, then state the building number followed by a dash and then the three digit room number. (e.g., 2-105)
6. Examples:
   a. 02:002-007 PS B2 F1 RM 2-105.
   b. 02:001-047 SD B1 F3 MECH RM.
   c. 02:004-034 DD B7 F3 N.E. CORRIDOR.
   d. 02:004-059 TRI HV-5A B7 F1 MCC.

## 3.2 FIELD QUALITY CONTROL

A. CERTIFICATE OF COMPLIANCE: Complete and submit to the project engineer in accordance with NFPA 72, paragraph 1.7.2.

B. FIELD - TESTING GENERAL:
1. Each addressable analog smoke detector shall be individually field tested prior to installing the device at its designated location to ensure reliability after shipment and storage conditions. A dated log indicating correct address, type of device, sensitivity and initials of the technician performing the test - using test equipment specifically designed for that purpose - shall be prepared and kept for final acceptance documentation. After testing, the detection devices and base shall be labeled with the system address, date and initials of installing technician. Labeling shall not be visible after installation is complete.
2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance (Megger), current and voltage readings shall be made as work progresses.
   a. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
   b. The acceptance inspector shall be notified before the start of any required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
   c. Test reports shall be delivered to the acceptance inspector as completed.
3. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
   a. Ladders and scaffolds as required to access all installed equipment.
   b. Multimeter for reading voltage, current and resistance.
   c. Intelligent device programmer-tester.
   d. Laptop computer with programming software for any required program revisions.
   e. Two way radios, flashlights, smoke generation devices and supplies.
   f. An approved device for measuring air flow through air duct smoke detector sampling assemblies.
   g. Decibel meter.
   h. Testing documentation.

4. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

C. FINAL ACCEPTANCE TESTING:

1. A written "Acceptance Test Procedure" (ATP) for testing the fire alarm system components and installation will be prepared by the Engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits and programming.
2. The acceptance inspector shall use the system record drawings in combination with the documents specified under paragraphs (3.1.C and 3.2.C) during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
   a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
      1) Open, shorted and grounded intelligent analog signaling line circuit.
      2) Open, shorted and grounded conventional initiating device circuits.
      3) Intelligent device removal.
      4) Primary power or battery disconnected.
      5) Incorrect device address.
   b. System evacuation alarm indicating appliances shall be demonstrated as follows:
      1) All alarm notification appliances actuate as programmed.
      2) Audibility and visibility at required levels.
   c. System indications shall be demonstrated as follows: Correct message display for each alarm input, at the control panel alphanumeric LCD display.
   d. System on-site and/or off-site reporting functions shall be demonstrated as follows:
      1) Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
      2) Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
      3) Trouble signals received for disconnect.
   e. Secondary power capabilities shall be demonstrated as follows:
      1) System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
      2) System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
      3) System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
3. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
   a. The installing contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.
   b. In the event that software changes are required during the ATP, the system manufacturer to compare the edited program with the original shall furnish a utility program. This utility shall yield a printed list of the changes and all system functions, inputs and outputs effected by the

changes. The items listed by this program shall be the minimum acceptable to be retested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP.

c. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete retesting.

D. DOCUMENTATION:

1. System documentation shall be furnished to the owner and shall include but not be limited to the following:
   a. System record drawings and wiring details including 3 sets of as-builts as well as as-builts on a CD-ROM in the current version of AutoCAD.
   b. System operation, installation and maintenance manuals.
   c. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
   d. System program "hard copy" showing system functions, controls and labeling of equipment and devices.
   e. All specified documentation as required under paragraphs (3.1.A and 3.2.C).

E. CLEANING: Contractor shall thoroughly clean all areas in which it works at the end of each work day and upon completion of installation.

F. TRAINING

1. The fire alarm contractor shall furnish training as follows for a minimum of four employees of the system user:
   a. Training in the receipt, handling and acknowledgment of alarms.
   b. Training on system operation including manual control of output functions from the FACP.
   c. The total training requirement shall be a minimum of 4 hours, but shall be sufficient to cover all items specified.

**END OF SECTION**