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**ARCHITECTURE**  
**INTERIOR DESIGN**  
**PLANNING**

**PROJECT MANUAL**

HOLIDAY INN EXPRESS & SUITES NANUET  
NEW 121 ROOM HOTEL  
THRUWAY PLAZA OF ROCKLAND ASSOCIATES  
CLARKSTON (NANUET) ROCKLAND COUNTY, NEW YORK

SVA PROJECT No.: 2018.009

ISSUE DATE  
BIDS/PERMITS 04.30.21

**SECTION 00 00 50**

**CONSULTANT INFORMATION**

**Project:** Holiday Inn Express & Suites  
New 121 Room Hotel  
Thruway Plaza of Rockland Associates  
Clarkstown (Nanuet)  
Rockland County, NY 10954

**SVA Project Number:** 2018.009

**Architect:** Stucky-Vitale Architects  
27172 Woodward Avenue  
Royal Oak, MI 48067  
(248) 546-6700

**Structural Engineer:** Desai/Nasar Consulting Engineers  
6765 Daly Road  
West Bloomfield, MI 48322-4585  
(248) 932-2010

**MEP Engineer:** Strategic Energy Solutions  
4000 W. 11 Mile Road  
Berkley, MI 48072  
(248) 399-1900

**Civil Engineer:** Dynamic Engineering  
245 Main Street, Suite 110  
Chester, NJ 07930  
(908) 879-9229

**Construction Manager:** William A. Randolph, Inc.  
820 Lakeside Drive, Suite 3  
Gurnee, IL 60031  
(847) 856-0123

**END OF SECTION**

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**END OF SECTION**

**SECTION 00 01 15**  
**LIST OF DRAWING SHEETS**

**LIST OF DRAWINGS**

- 1.01 THE LIST OF DRAWINGS AS INDICATED ON A002 IN THE SHEET INDEX ARE  
HEREBY INCORPORATED INTO THE CONTRACT DOCUMENTS AS DATED PER  
THE COVER PAGE OF THIS PROJECT MANUAL.**

**END OF SECTION**

**SECTION 00 31 32**  
**GEOTECHNICAL DATA**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Soils Investigation Data: Soil and subsurface investigations conducted at site by an independent testing laboratory and report with log of borings prepared.
  - 2. Report obtained for Architect and Engineer design use only.
  - 3. Copy of report is available included.

**1.02 GEOTECHNICAL INVESTIGATION DATA**

- A. Soil and subsurface investigations were conducted at site. Investigation results are documented in the report.
- B. Interpretation:
  - 1. Soils investigation data are available for information and convenience of Bidders, and is not warranted to indicate actual conditions.
  - 2. Owner, Architect, and Engineers do not assume responsibility for variations in kind, depth, quantity, and condition of soils. Owner, Architect, and Engineers disclaim responsibility for accuracy, true location, and extent of soils investigation prepared by others; and further disclaim responsibility for interpretation of soils investigation data by Bidders such as projecting soil bearing values, rock profiles, soil stability, and presence, level, and extent of underground water.
  - 3. Soils investigation report and data are not part of Contract Documents.
  - 4. Report any variances from Geotechnical Report in writing to the Owner's Representative.

**1.03 BIDDER INVESTIGATION**

- A. Bidder: Visit site and become familiar with site conditions.
- B. Bidder may, at Bidder's own expense and prior to bidding, make soil surveys and investigations Bidder considers necessary.
- C. Bidder assumes risk that soil and underground conditions may be other than that indicated in soil investigation data.
- D. Procedure:
  - 1. Obtain authorization from Owner prior to start of borings or subsurface investigations.
  - 2. Immediately upon completion of Bidder subsurface investigation, return site areas affected by investigations to condition existing prior to start of Bidder subsurface investigations as directed by Owner.

**1.04 CLAIMS**

- A. Claims for conditions found to be not as indicated in soil investigation data not permitted, unless otherwise indicated in Owner/Contractor agreement.

**PRODUCTS**

**2.01 NOT USED**

**EXECUTION**

**3.01 NOT USED**

**END OF SECTION**



## SECTION 00 81 00

### ADDENDUM TO GENERAL CONDITIONS FOR THE CONTRACT FOR CONSTRUCTION

#### 1.1.3 THE WORK

The Work comprises the completed construction required by the Contract Documents and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated or to be incorporated in such construction.

#### 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services. References to specifications of manufacturers, trade associations, or the like are understood to mean that such specifications are incorporated in the Specifications as if fully reproduced therein. "Approved", "equal", "acceptable" and similar words are understood to mean in the sole judgment of the Architect.

- 1.1.6.1 Should there be conflicts or discrepancies in the Drawings or Specifications between the quality of work or material, the higher (more expensive) quality shall take precedence unless otherwise directed by the Architect in writing.
- 1.1.6.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors, Sub subcontractors, material suppliers, equipment suppliers and fabricators and their agents and employees, and other persons or entities performing portions of the Work under a contract with the Contractor.
- 1.1.6.3 Products are generally specified by ASTM or other reference standard, and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any products or manufacturers complying with those standards. When a number of products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer or combination listed. When only one product or manufacturer is specified, the Contractor shall provide only that which is specified. There shall be no substitution of products or manufacturers after the Contract is executed.
- 1.1.6.4 Prior to the submission of bids, the Owner and Architect may consider a formal request for the substitution of products or manufacturers where the request is accompanied by complete data on the proposed substitution sufficient to substantiate full compliance with the Contract Documents including product identification and description, performance and test data, references and samples where applicable.
- 1.1.6.5 By making requests for substitutions as provided in paragraph 3.4.4, the Contractor:
  - .1 Represents that the Contractor has personally investigated the proposed substituted product and has determined that it is equal or superior in all respects to that specified,
  - .2 Represents that the Contractor will provide a warranty for the substituted product that is equal or superior to the warranty for the product specified,
  - .3 Waives all claims for additional costs related to the substituted product which subsequently become apparent, and
  - .4 Will coordinate the installation of the accepted substitute product making such changes as may be required for the Work to be complete in all respects.

- 1.1.6.6 Not later than thirty (30) days from the Contract Date, the Contractor shall furnish in writing to the Owner through the Architect a list showing the names of manufacturers proposed to be used for each of the products identified in the Specifications or on the Drawings and, as applicable, the name of the installing Subcontractor. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure to object to a manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents and all products furnished by the listed manufacturers must conform to such requirements.
- 1.1.6.7 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall include a reduction in the Contractor's overhead and profit. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.
- 1.1.6.8 The Contractor shall make no claim for damages for delay in the performance of this Contract occasioned by any act or omission of the public authority having jurisdiction over the Work or any of its representatives, and agrees that compensation for any such claim shall be limited to an extension of time to complete performance of the Work as provided herein.
- 1.1.6.9 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The work in the affected area shall not thereafter be resumed until the Owner has separately arranged for the asbestos or polychlorinated biphenyl (PCB) to be removed or rendered harmless, the removal or rendering is complete in accordance with applicable standards and requirements and has been certified safe by appropriate authorities. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless or removed and certified safe.
- 1.1.6.10 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Architect, Architect's Consultants and Agents and employees of any of them against claims, damages, losses and expenses, including but not limited to attorneys' fees arising out of or resulting from performance of the Work in the affected area, or from others not involved in performance of the Work or from anyone subsequently on the premises if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or in injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Subparagraph 10.1.4.
- 1.1.6.11 The Contractor shall maintain policies of employment as follows:
- 1.1.6.12 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment, notices setting forth the policies of nondiscrimination.

- 1.1.6.13 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.
- 1.1.6.14 All references to standards, whether for materials, processes, assemblies, workmanship, performance, or similar purpose shall mean, unless otherwise noted, the most recent available published version of such standard as of the date of the execution of the Contract. When reference is made to standards, such is understood to be made a part of the Contract Documents, and to have the same effect as if fully reproduced therein.

**END OF SECTION**

**SECTION 01 11 00**  
**SUMMARY OF WORK**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Project Description
  - 2. Definitions
  - 3. Quality Assurance
  - 4. Contractor Use of Premises
  - 5. Bidding Classification
  - 6. Contracts
  - 7. Owner Furnished Products
  - 8. Owner Provided Work
  - 9. Sample Room
  - 10. Allowances

**1.02 PROJECT DESCRIPTION**

- A. Work of this Contract comprises the general construction required for [a new] hotel, in city and state as indicated on the Project Manual cover.
- B. The Work includes, but is not limited to site, structural, architectural, plumbing, mechanical, and electrical systems. It also includes installation of furniture, fixtures and equipment (FF&E).
- C. The work of this Project is shown on the Drawings and described in the various Sections of the Specification.
- D. The Drawings and Specifications are complementary and what is required by any one shall be as binding as if required by all.
- E. The Project consists of the following:
  - 1. New construction of a [4]-story [wood frame] hotel consisting of [ 108 ] Guest Rooms with support functions.
  - 2. All new site improvements including parking, walks, landscaping, on-site utility services and tie-ins.
  - 3. [Outdoor] [Indoor] pool and spa.
  - 4. Renovations to existing hotel, as shown on Drawings, including, but not limited to:
    - a. Lobby and Public Areas
    - b. Guestrooms
    - c. Work includes adjoining outdoor areas.

**1.03 DEFINITIONS**

- A. Furnish: Purchase and deliver to project site, ready for installation.
- B. Install: Unpack, assemble, set in final position, fasten in place, make final connections, clean, adjust, and leave ready for use.
- C. Provide: Furnish and install.
- D. Receive: Accepting a delivery.
- E. Final Connections: Complete plumbing, mechanical, and electrical connections as required and recommended by manufacturer for optimum operation of equipment.
- F. Drawings, Use of: Do not scale the Drawings. If the Contractor chooses to calculate measurements by scaling the Drawings, it is at his own risk and is not considered to be an accurate measurement. The Contractor is responsible for the accuracy of measurements, elevations, lines, and grades of the Work.

**1.04 QUALITY ASSURANCE**

- A. It is the intent of the Owner and the Project Manual to conform with the AMERICANS WITH DISABILITIES ACT OF [2010].

### **1.05 CONTRACTOR USE OF PREMISES**

- A. General: Contractors shall limit their use of the premises to construction activities in areas indicated.
  - 1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
  - 2. Keep driveways and entrances serving the premises clear and available to the Owner at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
- B. Contractor shall assume full responsibility for protection and safe keeping of products under this Specification.

### **1.06 BIDDING CLASSIFICATION**

- A. This Project shall be performed under the following Prime Contracts:
  - 1. General Contract
- B. Contract Description: Construct the Work under the Contract as furnished by Owner.

### **1.07 OWNER FURNISHED PRODUCTS**

- A. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed Shop Drawings, Product Data, and Samples, to Contractor.
  - 2. Coordinate scheduling of, and arrange and pay for Product delivery to site.
  - 3. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 4. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
  - 1. Review Owner provided shop drawings, product data, and samples. Provide "takeoff" when requested.
  - 2. Coordinate scheduling, receive and unload products at site; inspect for completeness or damage. Notify shipper and Owner of incomplete and damaged shipments.
  - 3. Handle, store, install and finish products.
  - 4. Repair or replace items damaged after receipt.
- C. See listing "Owner Furnished Products/Work to be Provided" in Owner/Contractor Agreement.

### **1.08 OWNER PROVIDED WORK**

- A. Owner's Responsibilities:
  - 1. Arrange for shop drawings, product data and samples, if requested by Contractor.
  - 2. Coordinate scheduling of the Work.
- B. Contractor's Responsibilities:
  - 1. Review Owner reviewed shop drawings, product data, and samples if necessary.
  - 2. Coordinate schedule and provide supervision of the Work as Owner's on-site representative.
  - 3. Provide access, use of utilities, vertical transportation, and trash dumpster.
- C. See listing "Owner Furnished Products/Work to be Provided" in Owner-Contractor Agreement.

### **1.09 ALLOWANCES**

- A. Allowances include direct costs only. All costs for overhead, [home office and site], and profit are included in the Base Bid.
- B. See listing "Owner Furnished Products/Work to be Provided" in Owner/Contractor Agreement.

**PRODUCTS**

**2.01 NOT USED**

**EXECUTION**

**3.01 NOT USED**

**END OF SECTION**

**SECTION 01 31 00**  
**PROJECT MANAGEMENT AND COORDINATION**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Coordination
  - 2. Administrative Procedures
  - 3. Meetings:
    - a. Pre-construction Meetings
    - b. Progress Meetings
    - c. Preinstallation Meetings
  - 4. Coordination Drawings
  - 5. General Installation Provisions
  - 6. Cleaning and Protection
- B. Related Sections:
  - 1. Section 01 71 23 (01720) - Field Engineering
  - 2. Section 01 73 29 (01730) - Cutting and Patching

**1.02 REFERENCES**

**1.03 COORDINATION:**

- A. Coordinate construction activities included in various Sections of these Specifications to assure efficient and orderly installation of each component. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
- B. Where installation of one component depends on installation of other components before or after its own installation, schedule activities in the sequence required to obtain the best results.
- C. Coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.
- D. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- I. Make provisions to accommodate items scheduled for later installation.

**1.04 ADMINISTRATIVE PROCEDURES**

- A. Prepare memoranda for distribution to each party involved outlining required coordination procedures. Include required notices, reports, and attendance at meetings.
  - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- B. Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and ensure orderly progress. Such activities include:

1. Preparation of Schedules
  2. Installation and Removal of Temporary Facilities
  3. Delivery and Processing of Submittals
  4. Progress Meetings
  5. Project Closeout Activities
- C. Staff Names: Within 15 days of Notice to Proceed, submit a list of Contractor's staff assignments, including Superintendent and personnel at the site; identify individuals, their duties and responsibilities, addresses and telephone numbers.

#### **1.05 PRE-CONSTRUCTION MEETING**

- A. Refer to General Conditions, Article for requirements.
- B. Agenda:
1. Execution of Owner-Contractor Agreement.
  2. Submission of executed bonds and insurance certificates.
  3. Distribution of Contract Documents.
  4. Submission of lists of Subcontractors, Products, Schedule of Values, and Progress Schedule.
  5. Designation of personnel representing the parties in Contract.
  6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  7. Scheduling.
- C. Record minutes and distribute copies within one day after meeting faxed to participants, with one copy to Architect, Owner, participants, and those affected by decisions made.

#### **1.06 PROGRESS MEETINGS**

- A. Refer to General Conditions for requirements.
- B. Agenda:
1. Review minutes of previous meetings.
  2. Review of Work progress.
  3. Field observations, problems, and decisions.
  4. Identification of problems which impede planned progress.
  5. Review of submittals schedule and status of submittals.
  6. Review of off-site fabrication and delivery schedules.
  7. Maintenance of progress schedule.
  8. Corrective measures to regain projected schedules.
  9. Planned progress during succeeding work period.
  10. Coordination of projected progress.
  11. Maintenance of quality and work standards.
  12. Effect of proposed changes on progress schedule and coordination.
  13. Other business relating to Work.

#### **1.07 PRE-INSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a pre-installation meeting at work site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
  2. Review coordination with related work.
- E. Record minutes and distribute copies within one day after meeting faxed to participants, with one copy to Architect, Owner, participants, and those affected by decisions made.



### **1.08 COORDINATION DRAWINGS:**

- A. Prepare Coordination Drawings where close coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space necessitates maximum utilization of space for efficient installation of different components.
  - 1. Show relationship of components shown on separate Shop Drawings.
  - 2. Indicate required installation sequences.
  - 3. Refer to Division 22 Section "Common Work Results for Plumbing", Division 23 Section "Common Work Results for HVAC", and Division 26 Section "Common Work Results for Electrical", for requirements for plumbing, mechanical and electrical installations.

## **PRODUCTS**

### **2.01 NOT USED**

## **EXECUTION**

### **3.01 INSPECTION OF CONDITIONS:**

- A. The installer of each component shall inspect the substrate and conditions under which work is performed. Do not proceed until unsatisfactory conditions have been corrected.
- B. Verification of Conditions:
  - 1. Verify that existing conditions, surfaces, and substrates are acceptable for subsequent Work.
  - 2. Verify that field measurements, are as required to receive subsequent Work.
  - 3. Verify that existing substrate is capable of structural attachment of new Work being applied or attached.
  - 4. Examine and verify specific conditions described in individual specification sections.
  - 5. Verify that utility services are available, of the correct characteristics, and in the correct location.
- C. Report in writing to the [Architect] [Owner's Representative] prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to Owner.

### **3.02 PREPARATION**

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

### **3.03 GENERAL**

- A. Recheck measurements and dimensions before starting each installation.
- B. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

### **3.04 MANUFACTURER'S INSTRUCTIONS:**

- A. Comply with the manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- B. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- C. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

### **3.05 VISUAL EFFECTS:**

- A. Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

### **3.06 ENCLOSURE OF THE WORK:**

- A. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

### **3.07 MOUNTING HEIGHTS:**

- A. Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the [Architect] [Owner's Representative] for final decision.

### **3.08 CLEANING AND PROTECTION:**

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as often as necessary through the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise operations to ensure that no part of construction, completed or in progress, is subject to harmful or deleterious exposure. Such exposures include, but are not necessarily limited to, the following:
  - 1. Excessive Weathering
  - 2. Excessively High or Low Temperatures or Humidity
  - 3. Water or Ice
  - 4. Chemicals or Solvents
  - 5. Heavy Traffic, Soiling, Staining and Corrosion
  - 6. Contact Between Incompatible Materials
  - 7. Theft or Vandalism
  - 8. Excessive Static or Dynamic Loading
  - 9. Thermal Shock
  - 10. Combustion

**END OF SECTION**

**SECTION 01 33 00**  
**SUBMITTAL AND SUBSTITUTION PROCEDURES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or reference to recognized industry standards.
  - 2. To ensure that the specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data for its review and approval or rejection by the [Architect] [Owner's Representative].
  - 3. This Section specifies administrative and procedural requirements for submittals required for performance of the work, including:
    - a. Contractor's Progress Schedule
    - b. Shop Drawings, Product Data, and Samples
    - c. Letters of Conformance
    - d. Certificates
    - e. Manufacturer Installation Instructions
  - 4. Substitution Procedures
  - 5. Manuals
  - 6. Miscellaneous Submittals
- B. Related Documents:
  - 1. Letter of Conformance Form
  - 2. Contractor's Substitution Request Form
- C. Related Sections:
  - 1. Contractual Requirements for Submittals: General Conditions
    - a. Two (2) copies of all Submittals, plus number of copies to be returned to Contractor, shall be submitted unless otherwise specified.
    - b. Provide additional copies as required for use in Project Record Documents.
  - 2. Section 01 77 00 (01770) - Contract Closeout
  - 3. Individual Submittals Required: Pertinent Sections of these Specifications.

**1.02 SUBMITTALS**

- A. Coordination: Coordinate preparation and processing of Submittals with performance of construction activities. Transmit each Submittal sufficiently in advance of performance of related construction activities to avoid delay.
  - 1. Refer to General Conditions for additional requirements.
  - 2. Coordinate each Submittal with fabrication, purchasing, testing, delivery, other Submittals and related activities that require sequential activity.
  - 3. Coordinate transmittal of different types of Submittals for related elements of the work so processing will not be delayed by the need to review Submittals concurrently for coordination.
    - a. The [Architect] [Owner's Representative] reserves the right to withhold action on a Submittal requiring coordination with other Submittals until related Submittals are received.
    - b. No extension of Contract Time will be authorized because of failure to transmit Submittals to the Owner's Representative sufficiently in advance of the work to permit processing.
- B. Deliver Submittals to the [Architect] [Owner's Representative].
- C. Submittal Preparation: Place a permanent label or title block on each Submittal for identification. Indicate the name of the entity that prepared each Submittal on the label or title block.

1. Provide a space approximately 10" x 10" on the label or beside the title block on Shop Drawings to record the Contractor's and [Architect] [Owner's Representative] review and approval markings and the action taken.
  2. Include the following information on the label for processing and recording action taken:
    - a. Project Name
    - b. Name of the Owner
    - c. Date
    - d. Name and Address of Architect
    - e. Name and Address of Contractor
    - f. Name and Address of Subcontractor or Vendor
    - g. Location Where Item is to be Used
    - h. Name of Manufacturer
    - i. Drawing Number and Detail References, as Appropriate
    - j. Certification by the Contractor
- D. Submittal Transmittal: Package each Submittal appropriately for transmittal and handling. Transmit each Submittal from Contractor to [Architect] [Owner's Representative]. Submittals received from sources other than the Contractor will be returned without action.
1. Transmit each submittal to the Architect with "AIA Document G810 - Transmittal Letter" and "Letter of Conformance".
  2. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
  3. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
  4. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
  5. After [Architect] [Owner's Representative's] review of Submittal, revise and resubmit as required, identifying changes made since previous Submittal.
  6. When re-submittal is required for any reason, transmit under new letter of transmittal, indicating by reference to a previous Submittal that this is a re-submittal.
    - a. Identify on submittal all changes made since previous submission.
  7. Distribute copies of reviewed Submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.
  8. All Submittals shall bear the stamp of approval of the Contractor submitting same as evidence that they have been checked by him, or they will be rejected.
    - a. Must be signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
  9. Schedule submittals to expedite the Project, and deliver to [Architect] [Owner's Representative]. Coordinate submission of related items. Instruct parties to promptly report any inability to comply with provisions.

### **1.03 PROGRESS SCHEDULES**

- A. Submit initial Construction Progress Schedule in duplicate within 14 days after date of Owner-Contractor Contract. Submit in the form required by the General Conditions of the Contract.
- B. Revise and resubmit as required.
- C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
- D. Within 30 days after date of Owner-Contractor Agreement, submit all Letters of Conformance indicating Contractor's selections for products proposed for use, with name of manufacturer, trade name, and model number of each product. For products specified only by reference

standards, give manufacturer, trade name, model or catalog designation, and reference standards.

- E. Procedure:
  - 1. Submit the number of copies which the Contractor requires, plus [two] copies which will be retained by the [Architect] [Owner's Representative].
  - 2. Submit completed Letter of Conformance for products selected as indicated within each Section.
  - 3. Fill-in required information on form and sign in ink by person authorized to sign on behalf of the Contractor.
  - 4. Clearly identify applicable products, characteristics, models, and options. Attach supplemental information including product data to each Letter of Conformance as necessary to communicate all information specific to the product.
  - 5. No modifications to form permitted.
  - 6. Letters of Conformance are not to be used for substitution requests.
- F. By submitting a Letter of Conformance, Contractor declares that the product identified by manufacturer's name and model number:
  - 1. Is one of the product(s) specified
  - 2. Is suitable for the intended use as defined within the Contract Documents, and
  - 3. Will be provided and placed in operational condition in accordance with the Contract Documents and manufacturer's published instructions.

#### **1.04 SHOP DRAWINGS**

- A. Where Shop Drawings are required, submit newly prepared information drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings shall be drawn at a scale to clearly indicate all of the above conditions and allow for corrections or modifications which the Architect may wish to make. The Architect shall be the sole judge as to the acceptability of manufacturer's literature and catalog sheets as Shop Drawings.
- C. Shop Drawings shall clearly indicate all dimensional data for all parts of the item; types and materials for all connections; finishes; the exact relation of the item to adjacent materials and equipment in the completed structure including clearance, any necessary isolation, and fastening methods and devices; and mechanical and electrical connections.
- D. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates, and similar Drawings. Include the following information:
  - 1. Dimensions
  - 2. Identification of Products and Materials Included
  - 3. Compliance with Specified Standards
  - 4. Notation of Coordination Requirements
  - 5. Notation of Dimensions Established by Field Measurement
- E. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11", but no larger than 36" x 48".
- F. Submit in the form of one reproducible transparency and one opaque reproduction, or three opaque reproductions plus required amount to be returned to Contractor. After review, reproduce and distribute to appropriate parties.
- G. Do not permit Shop Drawing copies, without an appropriate final "Action" marking by the Architect, to be used in connection with the work.
- H. The Contractors shall be responsible for distribution of additional prints to vendors, etc.

## 1.05 PRODUCT DATA

- A. Where Product Data is required, collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
  - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's Printed Recommendations
    - b. Compliance with Recognized Trade Association Standards
    - c. Compliance with Recognized Testing Agency Standards
    - d. Application of Testing Agency Labels and Seals
    - e. Notation of Dimensions Verified by Field Measurement
    - f. Notation of Coordination Requirements
    - g. Type and Model Numbers
  - 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
- B. Distribution: Furnish copies of final Submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
  - 1. Do not proceed with installation until a copy of Product Data applicable is in the installer's possession.
  - 2. Do not permit use of unmarked copies of Product Data in connection with construction.

## 1.06 SAMPLES

- A. Where Samples are required, submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, full color-range sets, and swatches showing color, texture, and pattern.
  - 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Include the following:
    - a. Generic Description of the Sample
    - b. Sample Source
    - c. Product Name or Name of Manufacturer
    - d. Compliance with Recognized Standards
    - e. Availability and Delivery Time
  - 2. Colors:
    - a. General: Unless the precise color and pattern is specifically described in the Contract Documents, whenever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Architect for his review and selection.
  - 3. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between the final Submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture, or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3) that show approximate limits of the variations.
    - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample Submittals.

4. Preliminary Submittals: Where Samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
    - a. Preliminary Submittals will be reviewed and returned with the Architect's mark indicating selection and other action.
  5. Maintain sets of Samples, as returned, at the Project site for quality comparisons throughout the course of construction.
    - a. Unless noncompliance with Contract Document provisions is observed, the Submittal may serve as the final Submittal.
    - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to Subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the work.
1. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
    - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

#### **1.07 CERTIFICATES**

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

#### **1.08 MANUFACTURER INSTALLATION INSTRUCTIONS**

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

### **PRODUCTS**

#### **2.01 SUBSTITUTIONS**

- A. Source Limitations: To the greatest extent possible for each unit of work, provide products, materials, or equipment of a singular generic kind from a single source.
- B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product or materials, select an option which is compatible with other products and materials already selected (which may have been from among options for those other products and materials). Total compatibility among options, if not assured by limitations within contract documents, must be provided by Contractor. Compatibility is a basic general requirement of product/material selections.
- C. Owner's Approval Required:
  1. In addition to the following, refer to the General Conditions, Article 4, for additional requirements.
  2. The Contract is based on the materials, equipment, and methods described in the Contract Documents.
  3. The Contract Drawings and Specifications establish the "minimum standard of quality" each product and/or system must meet to be considered acceptable. Products of other manufacturers will be considered if the product and/or system meets or exceeds the "minimum standard of quality" established by the Contract Documents.

4. The Owner will consider proposals for substitutions under the "or approved substitution" and the "or approved equal" provision of materials, equipment, and methods, only when such proposals are accompanied by full and complete technical data and all other information required by the Owner and Architect to evaluate the proposed substitutions.
    - a. It will be the responsibility of the submitting Contractor to prove equality.
    - b. Request must include "Contractor's Substitution Request" Form, a copy of which is attached to this Section.
    - c. The Submittal shall include a line-by-line, item-by-item description of the specified and proposed product.
  5. Requests for substitutions must be submitted to the [Architect] [Owner's Representative] NO later than 60 days after date of Owner-Contractor Agreement.
  6. DO NOT SUBSTITUTE MATERIALS, EQUIPMENT, OR METHODS UNLESS SUCH SUBSTITUTIONS HAVE BEEN SPECIFICALLY APPROVED FOR THIS WORK IN WRITING.
- D. "Or Approved Equal" or "Or Approved Substitution"
1. Where the phrase "or approved equal" or "approved substitution" occurs in the Contract Documents, do not assume that material, equipment, or methods will be approved as equal by the Owner and Architect unless the item has been specifically approved for this work by the Owner.
    - a. Color choices will be one of the determining factors for approval.
  2. The decision of the Owner will be final.
- E. Availability of Specified Items:
1. Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the work.
  2. In the event specified item or items will not be so available, so notify the [Architect] [Owner's Representative] prior to the receipt of Bids.
  3. Costs of delay caused on non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by the Owner.
- F. Whenever the Contractor secures approval for changing any items and such change involves a corresponding change or adjustment in any adjacent or related item, the responsibility for making the required change, or seeing that it is made, rests with the Contractor. The cost of these changes and/or adjustments shall be paid for by the Contractor unless it is otherwise agreed, in writing, at the time the change is approved. The acceptance of any change will not, in any way, relieve the Contractor from full compliance with the Contract Documents.

## **2.02 MANUALS**

- A. General: Where Manuals are required to be submitted covering items included in this work, prepare all such Manuals in durable plastic binders approximately 8-1/2 x 11 inches in size with at least the following:
1. Identification on or readable through the front cover stating the general nature of the Manual.
  2. Neatly typewritten index near the front of the Manual furnishing immediate information as to location of all emergency data regarding the installation.
  3. Complete instructions regarding operating and maintenance of all equipment involved.
  4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of nearest vendor of parts.
  5. Copy of all guarantees and warranties issued.
  6. Copy of approved Shop Drawing(s) with all data concerning all changes made during construction

## **2.03 MISCELLANEOUS SUBMITTALS**

- A. Inspection and Test Reports Not Performed by Owner: Classify each inspection and test report as being either "Shop Drawings" or "Product Data" depending on whether the report is specially



prepared for the project or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

## **EXECUTION**

### **3.01 COORDINATION OF SUBMITTALS**

- A. Refer to General Conditions, Article 16, for additional requirements.
- B. General: Prior to submittal for Architect's review, use all means necessary to fully coordinate all material, including the following:
  - 1. Secure all necessary approvals from public agencies and others. Signify by stamp or other means that all required approvals have been obtained.
  - 2. Clearly indicate all deviations from the Contract Documents.
- C. The General Contractor shall submit a prioritized tabulation by date of Submittals required during the first 90 days of construction. List those Submittals required to maintain orderly progress of the work, and those required early because of long lead time for manufacture or fabrication.
  - 1. These dates may be shown on Construction Project Schedule at Contractor's option.

### **3.02 TIMING OF SUBMITTALS**

- A. General
  - 1. Make all Submittals enough in advance of scheduled dates for installation to provide all required time for reviews for securing necessary approvals, for possible revision and Resubmittals, and for placing orders and securing delivery.
  - 2. In scheduling, allow a minimum of fourteen (14) full calendar days for the Architect's initial review following receipt of the Submittals. Allow additional time if the Architect requires coordination with subsequent Submittals.
    - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related Submittals are received.
    - b. If an Intermediate Submittal is necessary, process the same as the initial Submittal. Allow fourteen (14) calendar days for reprocessing each Submittal.

### **3.03 LETTER OF CONFORMANCE**

PROJECT: \_\_\_\_\_ PROJECT NO.: \_\_\_\_\_  
CITY: \_\_\_\_\_ STATE: \_\_\_\_\_  
CONTRACTOR: \_\_\_\_\_

THE FOLLOWING PRODUCT(S) HAS BEEN SELECTED FOR USE IN THE ABOVE REFERENCED PROJECT FROM THE LIST OF SPECIFIED ITEMS.

<b>SECTION NUMBER:</b>	_____	<b>SECTION NAME:</b>	_____
<b>DRAWING</b>	_____	<b>DETAIL</b>	_____
<b>NUMBER(S):</b>	_____	<b>NUMBER(S):</b>	_____

**SPECIFIED ITEM TO BE USED:**

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**STATEMENT OF CONFORMANCE:**

THIS LETTER OF CONFORMANCE IS PROVIDED AS A SUBMITTAL FOR INFORMATION IN ACCORDANCE WITH SECTION 01 33 00 - SUBMITTALS AND SUBSTITUTIONS. THE UNDERSIGNED HEREBY DECLARES THAT THE PRODUCT IDENTIFIED ABOVE BY MANUFACTURER'S NAME AND MODEL NUMBER IS (ONE OF) THE PRODUCT(S) SPECIFIED AND IS SUITABLE FOR THE INTENDED USE AS DEFINED WITHIN THE CONTRACT DOCUMENTS AND WILL BE PROVIDED AND PLACED IN OPERATIONAL CONDITION IN ACCORDANCE WITH THE MANUFACTURER'S PUBLISHED INSTRUCTIONS AND THE CONTRACT DOCUMENTS.

SUBCONTRACTOR/SUPPLIER:

PHONE ( )  
NUMBER: \_\_\_\_\_

\_\_\_\_\_  
(CONTACT NAME OF SUBCONTRACTOR/SUPPLIER OFFERING ABOVE PRODUCT)

\_\_\_\_\_  
(SUBCONTRACTOR / SUPPLIER NAME AND ADDRESS)

CONTRACTOR:

\_\_\_\_\_  
(CONTACT NAME OF CONTRACTOR)

\_\_\_\_\_  
(CONTRACTOR SIGNATURE AND TITLE OF SIGNATORY)

### CONTRACTOR'S SUBSTITUTION REQUEST

(USE SEPARATE FORM FOR EACH REQUEST)

DATE:

REQUEST  
NO.: \_\_\_\_\_

TO: [ARCHITECT] [OWNER'S  
REPRESENTATIVE]  
PHONE : \_\_\_\_\_

FAX: \_\_\_\_\_

PROJECT:

PROJECT  
NO.: \_\_\_\_\_

CONTRACTOR \_\_\_\_\_

SPECIFIED ITEM:

SECTION

PAGE: \_\_\_\_\_

PARAGRAPH

DESCRIPTION: \_\_\_\_\_

N:

APH: \_\_\_\_\_

DRAWING

DETAIL

NUMBER(S): \_\_\_\_\_

NUMBER(S): \_\_\_\_\_

THE UNDERSIGNED REQUEST CONSIDERATION OF THE FOLLOWING:

PROPOSED SUBSTITUTION: \_\_\_\_\_

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS: \_\_\_\_\_

SAVINGS OR CREDIT TO OWNER FOR ACCEPTING  
SUBSTITUTE: \_\_\_\_\_

\$ \_\_\_\_\_

ATTACHED DATA INCLUDES DESCRIPTION, SPECIFICATIONS, DRAWINGS, PHOTOGRAPHS, PERFORMANCE AND TEST DATA ADEQUATE FOR EVALUATION OF THE REQUEST; APPLICABLE PORTIONS OF THE DATA ARE CLEARLY IDENTIFIED.

ATTACHED DATA ALSO INCLUDES A DESCRIPTION OF CHANGES TO THE CONTRACT DOCUMENTS THAT THE PROPOSED SUBSTITUTION WILL REQUIRE FOR ITS PROPER INSTALLATION.

THE UNDERSIGNED CERTIFIES THAT THE FOLLOWING PARAGRAPHS, UNLESS MODIFIED BY ATTACHMENTS, ARE CORRECT:

0. PROPOSED SUBSTITUTION HAS BEEN FULLY CHECKED AND COORDINATED WITH THE CONTRACT DOCUMENTS. 1. THE PROPOSED SUBSTITUTION DOES NOT AFFECT DIMENSIONS SHOWN ON DRAWINGS. 2. THE PROPOSED SUBSTITUTION DOES NOT REQUIRE REVISIONS TO MECHANICAL OR ELECTRICAL WORK. 3. THE UNDERSIGNED WILL PAY FOR CHANGES TO THE BUILDING DESIGN, INCLUDING ARCHITECTURAL AND ENGINEERING DESIGN, DETAILING, AND CONSTRUCTION COSTS CAUSED BY THE REQUESTED SUBSTITUTION. 4. THE PROPOSED SUBSTITUTION WILL HAVE NO ADVERSE AFFECT ON OTHER TRADES, THE CONSTRUCTION SCHEDULE, OR SPECIFIED WARRANTY REQUIREMENTS. 5. MAINTENANCE AND SERVICE PARTS WILL BE LOCALLY AVAILABLE FOR THE PROPOSED SUBSTITUTION. 6. THE PROPOSED SUBSTITUTION WILL HAVE NO ADVERSE EFFECT ON LEED CREDITS ESTABLISHED THROUGH THE CFRST LEED VOLUME PROGRAM. (APPLIES TO CFRST LEED VOLUME PROGRAM PROJECTS ONLY)

THE UNDERSIGNED FURTHER STATES THAT THE FUNCTION, APPEARANCE, AND QUALITY OF THE PROPOSED SUBSTITUTION ARE EQUIVALENT OR SUPERIOR TO THE SPECIFIED ITEM.

ATTACHMENTS: THE ATTACHED DATA IS FURNISHED HEREWITH FOR EVALUATION OF THE PROPOSED SUBSTITUTION.

☐ CATALOG ☐ DRAWINGS ☐ SAMPLES ☐ REPORTS ☐ TESTS ☐ OTHER: \_\_\_\_\_

SUBMITTED BY: \_\_\_\_\_

\_\_\_\_\_  
(FIRM)

\_\_\_\_\_  
(AUTHORIZED LEGAL  
SIGNATURE)

(  
)

\_\_\_\_\_  
(ADDRESS)

\_\_\_\_\_  
(TELEPHONE)

FOR USE BY THE  
ARCHITECT:  
BY:

☐ ACCEPTED

☐ ACCEPTED AS  
NOTED

☐ REJECTED: SUBMIT SPECIFIED ITEM

\_\_\_\_\_  
(AUTHORIZED SIGNATURE)

DATE: \_\_\_\_\_

REMARK  
S: \_\_\_\_\_

# Materials Submittal Form

**Project Name:** \_\_\_\_\_

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. To fulfill the requirements of this program, this form must be completed for **each building material** (i.e. drywall, insulation, steel studs, etc) that you will be furnishing to the project. Wet-applied products are not included – please refer to the VOC Submittal Form.

Provide all of the information requested in the box below. Write "N/A" or "?" for information that does not apply or is undetermined. For questions about completing this form, please contact the general contractor for the project.

<b>Sub-Contractor:</b> _____	<b>Spec Section:</b> _____
<b>Contact Name:</b> _____	<b>Manufacturer:</b> _____
<b>Date:</b> _____	<b>Product Name:</b> _____
<b>Material Cost (minus on-site labor and equipment):</b> \$ _____	
<b>Material Source Location:</b>	
Location of Manufacture <sup>1</sup> : _____ City/State _____ Miles from project	
Location of Harvest/Extraction <sup>2</sup> : _____ City/State _____ Miles from project	
<input type="checkbox"/> I have attached manufacturer documentation stating the location of manufacture and harvest/extraction.	
<b>Recycled Content<sup>3</sup>:</b>	
% Post-Consumer: _____ %	
% Pre-Consumer / Post-Industrial: _____ %	
(Combined total cannot equal >100%)	
<input type="checkbox"/> I have attached manufacturer documentation stating the percentage of recycled content.	
<b>Flooring and Wall and Ceiling (for all flooring, gypboard, ceiling tiles and insulation) :</b>	
Carpet: _____ (Y/N)	CRI Green Label Plus Certified?
Carpet Backing: _____ (Y/N)	CRI Green Label Certified?
Carpet Adhesive: _____ (Y/N)	VOC not to exceed 50 g/l
<input type="checkbox"/> I have attached manufacturer documentation stating that the flooring meets the specified requirement.	
<b>Signature:</b> _____	<b>Date:</b> _____

<sup>1</sup> Manufacturing location refers to the final assembly of components into a building product. For example, the location of manufacture for structural steel would be the address of the fabrication shop (not the steel mill).

<sup>2</sup> Location of Harvest is where raw materials were extracted from the ground. For example, the location of harvest for gypsum is the gypsum mine. If the gypsum is recycled, then the harvest location is the gypsum recycling plant.

<sup>3</sup> Post-consumer content is from previous consumer use (bottles, cars) and post-industrial content is recaptured from the industrial process (fly ash, metal trimmings). If the type of recycled content is not specified, assume it is pre-consumer/post-industrial.

# Materials Submittal Form Concrete

**Project Name:** \_\_\_\_\_

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. To fulfill the requirements of this program, this form must be completed for each different concrete mix that is used for the project.

Please fill out the information below. Gray boxes may be left blank. Write "N/A" or "?" for information that does not apply or is undetermined. For questions, please contact the contractor from whom you received this form.

**Sub-Contractor:** \_\_\_\_\_ **Manufacturer:** \_\_\_\_\_

**Contact:** \_\_\_\_\_

<b>Concrete</b>	Cost per cubic yard of mix (minus labor and equipment):	\$
	Volume of concrete provided (cubic yards):	CY
	Location of Manufacture <sup>1</sup> :	City / State
		Miles from project site

**Concrete Mix Name/Number:** \_\_\_\_\_

Component <sup>2</sup>	% of mix (by weight)	% Recycled Content <sup>3</sup> (Post-Consumer)	(Post-Industrial)	Location of Harvest <sup>4</sup> (City, State)	Miles from Project
Cement					
Flyash			100%		
Aggregate 1: _____					
Aggregate 2: _____					
Sand					
Other: _____					

☐ I have included a manufacturer mix report that confirms the information in this chart.

<b>Signature:</b> _____	<b>Date:</b> _____
-------------------------	--------------------

<sup>1</sup> Location of Manufacture refers to the address of the facility where the mix was combined.

<sup>2</sup> Water and chemical additives may be omitted from the component list.

<sup>3</sup> Post-consumer content is from previous consumer use (ex: crushed pavement) and post-industrial content is recaptured from the industrial process (ex: fly ash). If the type of recycled content is not known, assume it is post-industrial.

<sup>4</sup> Location of Harvest is where raw materials are extracted from the ground. For example, the location of harvest for aggregate is where the stone was mined. If the aggregate is recycled, then the harvest location is where the rock was crushed for recycling.

# Materials Submittal Form

## Wood Products

The project team is using the LEED Rating System® ([www.USGBC.org/LEED](http://www.USGBC.org/LEED)) to measure the environmental impacts of the project. Therefore, the project team is pursuing and tracking materials the types of materials that are being used to construct the project.

Please fill out the information in the box below for each wood material that you will be furnishing to the project. Write "N/A" in any field that does not apply and a "?" for any information that you are unable to determine.

<b>Contractor:</b> _____ <b>Contact:</b> _____ <b>Date:</b> _____	<b>Spec Section:</b> _____ <b>Material Name:</b> _____ <b>Manufacturer:</b> _____
<b>Material Cost (minus labor and equipment):</b> \$ _____	
<input type="checkbox"/> I have attached invoices for all wood products <sup>1</sup> . <small><sup>1</sup> All invoices must: identify each wood product on a line-item basis; identify each FSC product on a line-item basis; include the dollar value for each line-item; and include the vendor's FSC Chain of Custody number if the invoice includes FSC items.</small>	
<b>Material Source Location</b> Location of Fabrication: City/State _____ Miles from project site _____ Location of Forest: City/State _____ Miles from project site _____	
<b>Recycled Content<sup>2</sup></b> Post-Consumer Content: _____ %    Pre-Consumer / Post-Industrial Content: _____ % <input type="checkbox"/> I have attached manufacturer documentation stating the percentage of recycled content. <small><sup>2</sup> Post-consumer content is waste that has been recaptured after consumer use. Post-industrial content is recycled waste that has been captured from industrial processes. If the type of recycled content is not specified, assume it is post-industrial.</small>	
<b>Salvaged Wood Content<sup>3</sup></b> _____ % <input type="checkbox"/> I have attached manufacturer information stating where the wood was salvaged from. <small><sup>3</sup> Salvaged wood comes from the deconstruction of another building or structure.</small>	
<b>FSC Certified Wood<sup>4</sup></b> Chain of Custody Certificate Number: _____ <input type="checkbox"/> I have attached a copy of the FSC Chain of Custody Certificate or Manufacturer documentation stating the product or product component is FSC certified. <small><sup>4</sup> Only Forest Stewardship Council (FSC) certification qualifies for LEED compliance. Sustainable Forest Initiative (SFI) or other certification bodies DO NOT QUALIFY and are not acceptable substitutions for FSC certification.</small>	
<b>Composite Wood Content<sup>5</sup></b> Contains Urea-Formaldehyde Resins? _____ (Y/N) <input type="checkbox"/> I have attached manufacturer documentation stating that the composite wood DOES NOT contain any added urea-formaldehyde resins. <small><sup>5</sup> Composite wood products include plywood, MDF, particleboard, wheatboard, bamboo, etc. Laminating adhesives used for shop fabrication and on-site fabrication of composite assemblies must also be free of added urea-formaldehyde resins.</small>	
<b>Signature:</b> _____ <b>Date:</b> _____	

LEED Wood Materials Form, © 2010 Paladino

# VOC Submittal Form

**Project Name:** \_\_\_\_\_

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. A major goal of this program is to reduce the quantity of indoor air contaminants that are odorous or potentially harmful to the well-being of installers and occupants. To fulfill the requirements of this program, **this form must be completed for each product that is wet-applied within the interior vapor barrier of the project.**

**All products must be compliant with the Volatile Organic Compound (VOC) limitations that are reported on page two of this document.** Please refer to the Pre-Approved Products List for product suggestions. If an alternative product is selected, please provide a copy of the Material Safety and Data Sheet (MSDS) with the VOC Submittal Form. The MSDS must state VOC content in **grams per liter**. If this information is not included in the MSDS, please request the VOC content (in grams/liter) from the manufacturer. Do not assume a zero VOC content if the information is not shown.

Please fill out the information in the chart below:

<b>Sub Contractor:</b> _____	<b>Spec Section:</b> _____			
<b>Contact:</b> _____	<b>Date:</b> _____			
I plan on using the following VOC containing Adhesives, Sealants, Primers and/or Paint on the interior of the project:				
Product Name: (manufacturer and product ID)	Type of Product: (adhesive, sealant, paint, etc)	The product is used for: (application description)	VOC Content in g/L (from attached MSDS)	Allowable VOC Content in g/L (from charts on the next page)
<input type="checkbox"/> I have attached a copy of the MSDS stating the VOC content for each product listed above.				
By signing below, I hereby confirm that these are the only wet-applied products that I will use on the interior of the building.				
<b>Signature:</b> _____		<b>Date:</b> _____		

If you have any questions, please contact the general contractor.  
Thank you for complying with the LEED requirements and contributing to the goals of this project.

**END OF SECTION**





**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Reference Standards

**1.02 QUALITY ASSURANCE**

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

**1.03 INDUSTRY STANDARDS**

- A. Reference Standards
  - 1. Conform with the provisions or standards referenced in the sections of the Specifications with the same force and effect as if the Standards referenced were bound or copied directly into the section, except that:
    - a. Conform with more stringent provisions when contained elsewhere in the Contract Documents; and
    - b. Conform with the more stringent provision when two or more Standards are referenced; and
    - c. Conform with the more stringent provision when the Standard referenced and the governing regulations differ unless the governing regulation require conformance to the less stringent provision without exception.
    - d. Submit for clarification and conform to the decision of the Architect when the Standard referenced:
      - 1) Presents options which have not specifically been selected in the Contract Documents; or
      - 2) Contain provisions which conflict with other provisions in the Contract Documents; or
      - 3) It is uncertain or not clear which of differing provisions is the more stringent.
    - e. Conform to the provisions of the most recent issue of the Standard referenced as of the date of the Contract Documents.
  - 2. Abbreviations and Acronyms of Organizations
    - a. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade and Professional Associations of the U.S.," which are available in most libraries.
    - b. The names, addresses, and telephone numbers given in the List of Organizations are subject to change and are believed to be, but are not assured to be, accurate and up to date as of the issue date of this Section.
    - c. List of Organizations: Certain Standards issued by the following organizations may be referenced in the Specifications. Copies may be obtained from the issuing organization.

- B. The Aluminum Association, Inc. (703) 358-2967  
1525 Wilson Blvd, Suite 600  
[www.aluminum.org](http://www.aluminum.org)
- C. Rosslyn, Arlington, VA 22209
- D. Associated Air Balance Council (202) 737-0202  
1518 K St., NW  
[www.aabchq.com](http://www.aabchq.com)
- E. Washington, DC 20005
- F. American Architectural Manufacturer's Association (847) 303-5664
- G. 1827 Walden Office Sq., Suite 550  
[www.aamanet.org](http://www.aamanet.org)
- H. Schaumburg, IL 60173
- I. AASHTO American Association of State Highway and  
(202) 624-5800
- J. Transportation Officials [www.transportation.org](http://www.transportation.org)
- K. 444 Capitol St., Suite 249
- L. Washington, DC 20001
- M. American Association of Textile Chemists and Colorists  
(919) 549-8141
- N. P O Box 12215 [www.aatcc.org](http://www.aatcc.org)
- O. Research Triangle Park, NC 27709
- P. American Concrete Institute (248) 848-3700
- Q. 38800 Country Club Drive [www.aci-int.org](http://www.aci-int.org)
- R. Farmington Hills, MI 48331
- S. American Composites Manufacturers Association (703) 525-0511
- T. 1010 North Glebe Rd, Suite 450  
[www.acmanet.org](http://www.acmanet.org)
- U. Arlington, VA 22201
- V. American Concrete Pipe Association (972) 506-7216
- W. 1303 West Walnut Hill Lane, Suite 305  
[www.concrete-pipe.org](http://www.concrete-pipe.org)
- X. Irving, TX 75038-3008
- Y. Air Diffusion Council (847) 706-6750
- Z. 1901 N. Roselle Road, Suite 800  
[www.flexibleduct.org/](http://www.flexibleduct.org/)
- AA. Schaumburg, IL 60195
- AB. American Forest & Paper Association (800) 878-8878
- AC. 1111 Nineteenth Street, NW, Suite 800  
[www.afandpa.org](http://www.afandpa.org)
- AD. Washington, DC 20036
- AE. American Wood Council (202) 463-2766
- AF. 1111 Nineteenth Street, NW, Suite 800  
[www.awc.org](http://www.awc.org)
- AG. Washington, DC 20036
- AH. American Gas Association (202) 824-7000

AI. 400 North Capitol St. NW, Suite 450	<a href="http://www.aga.org">www.aga.org</a>
AJ. Washington, DC 20001	
AK. Associated General Contractors of America (703) 548-3118	
AL. 2300 Wilson Blvd., Suite 400	<a href="http://www.agc.org">www.agc.org</a>
AM. Arlington, VA 22201	
AN. American Hardboard Association	(847) 934-8803
AO. 1210 W. Northwest Hwy	<a href="http://domensino.com/AHA">domensino.com/AHA</a>
AP. Palatine, IL 60067-1897	
AQ. Association of Home Appliance Manufacturers	(202) 872-5955
AR. 1111 19th Street NW, Suite 402	<a href="http://www.aham.org">www.aham.org</a>
AS. Washington, DC 20036	
AT. Asphalt Institute	(859) 288-4960
AU. 2696 Research Park Dr.	<a href="http://www.asphaltinstitute.org">www.asphaltinstitute.org</a>
AV. Lexington, KY 40511	
AW. The American Institute of Architects	(202) 626-7492
AX. 1735 New York Ave., NW	<a href="http://www.aia.org">www.aia.org</a>
AY. Washington, DC 20006-5292	
AZ. American Insurance Association	(202) 828-7100
BA. 2101 L Street NW, Suite 400	<a href="http://www.aiadc.org">www.aiadc.org</a>
BB. Washington, DC 20037	
BC. AIMCAL Association of Industrial Metallizers, Coaters and Laminators (803) 802-7820	
BD. 201 Springs Street	<a href="http://www.aimcal.org">www.aimcal.org</a>
BE. Fort Mill, SC 29715	
BF. American Institute of Steel Construction	(312) 670-2400
BG. One East Wacker Dr., Suite 700	<a href="http://www.aisc.org">www.aisc.org</a>
BH. Chicago, IL 60601-1802	
BI. American Iron and Steel Institute	(202) 452-7100
BJ. 1140 Connecticut Avenue NW #705	<a href="http://www.steel.org">www.steel.org</a>
BK. Washington, DC 20036	
BL. Associated Laboratories, Inc.	(214) 565-0593
BM. P.O. Box 152837	
BN. 1323 Wall St.	
BO. Dallas, TX 75215	
BP. American Lumber Standards Committee	(301) 972-1700
BQ. 19715 Waters Road	
BR. Germantown, MD 20874	
BS. Air Movement and Control Association International, Inc. (847) 394-0150	
BT. 30 W. University Dr.	<a href="http://www.amca.org">www.amca.org</a>
BU. Arlington Heights, IL 60004-1893	

BV. American National Standards Institute	(212) 642-4900
BW. 25 West 43rd Street, 4th Floor	<a href="http://www.ansi.org/">www.ansi.org/</a>
BX. New York, NY 10036	
BY. APA-The Engineered Wood Association	(253) 565-6600
BZ. (Formerly: American Plywood Association)	
<a href="http://www.apawood.org">www.apawood.org</a>	
CA. 7011 S. 19th Street	
CB. Tacoma, WA 98466-5333	
CC. Architectural Precast Association	(239) 454-6989
CD. 6710 Winkler Road	<a href="http://www.archprecast.org">www.archprecast.org</a>
CE. Fort Myers, FL 33919	
CF. Air-Conditioning, Heating and Refrigeration Institute	(703) 524-8800
CG. 2111 Wilson Blvd., Suite 500	<a href="http://www.ari.org">www.ari.org</a>
CH. Arlington, VA 22201	
CI. Asphalt Roofing Manufacturer's Association	
(202) 207-0917	750 National Press Building
<a href="http://www.asphaltroofing.org">www.asphaltroofing.org</a>	
CJ. 529 14th Street, NW	
CK. Washington, DC 20045	
CL. Acoustical Society of America	(516) 576-2360
CM. 2 Huntington Quadrangle	<a href="http://asa.aip.org">asa.aip.org</a>
CN. Melville, NYU 11747-4502	
CO. Adhesive and Sealant Council	(202) 452-1500
CP. 7101 Wisconsin Ave., Suite 990	
<a href="http://www.ascouncil.org">www.ascouncil.org</a>	
CQ. Bethesda, MD 20814	
CR. American Society of Civil Engineers	(800) 548-2723
CS. World Headquarters	(703) 295-6000
CT. 1801 Alexander Bell Dr.	<a href="http://www.asce.org">www.asce.org</a>
CU. Reston, VA 20191-4400	
CV. ASHRAE American Society of Heating, Refrigerating	
(800) 527-4723	
CW. and Air-Conditioning Engineers	(404) 636-8400
CX. 1791 Tullie Circle, NE	<a href="http://www.ashrae.org">www.ashrae.org</a>
CY. Atlanta, GA 30329-2305	
CZ. American Society of Landscape Architects	
(202) 898-2444	
DA. 636 Eye Street NW	<a href="http://www.asla.org">www.asla.org</a>
DB. Washington, DC 20001-3736	
DC. American Society of Mechanical Engineers	
(800) 434-2763	
DD. Three Park Avenue	<a href="http://www.asme.org">www.asme.org</a>
DE. New York, NY 10016-5990	

DF. Turfgrass Producers International	(847) 649-5555
DG. Formerly: American Sod Producers Association <a href="http://www.turfgrasssod.org">www.turfgrasssod.org</a>	
DH. 2 East Main Street	
DI. East Dundee, IL 60118	
DJ. American Society of Plumbing Engineers	(773) 693-2773
DK. 8614 Catalpa Avenue, Suite 1007	<a href="http://aspe.org">aspe.org</a>
DL. Chicago, IL 60656-1116	
DM. American Society of Sanitary Engineering (440) 835-3040	
DN. 901 Canterbury Road, Suite A <a href="http://www.asse-plumbing.org">www.asse-plumbing.org</a>	
DO. Westlake, OH 44145	
DP. American Society for Testing and Materials (610) 832-9500	
DQ. 100 Barr Harbor Dr., PO Box C700	<a href="http://www.astm.org">www.astm.org</a>
DR. West Conshohocken, PA 19428-2959	
DS. Association of the Wall and Ceiling Industry (703) 538-1600	
DT. 513 West Broad Street, Suite 210	<a href="http://www.awci.org">www.awci.org</a>
DU. Falls Church, VA 22046	
DV. Architectural Woodwork Institute	(571) 323-3636
DW. 46179 Westlake Drive, Suite 120	<a href="http://www.awinet.org">www.awinet.org</a>
DX. Potomac Falls, VA 20165	
DY. American Wood Protection Association	(205) 733-4077
DZ. 100 Chase Park South, Suite 116	<a href="http://www.awpa.com">www.awpa.com</a>
EA. Birmingham, AL 35244-1851	
EB. American Welding Society	(800) 443-9353
EC. 550 NW Leleune Rd.	(305) 443-9353
ED. Miami, FL 33126	<a href="http://www.aws.org/">www.aws.org/</a>
EE. American Water Works Association	(800) 926-7337
EF. 6666 W. Quincy Ave.	(303) 794-7711
EG. Denver, CO 80235	<a href="http://www.awwa.org">www.awwa.org</a>
EH. Builders Hardware Manufacturers Association	(212) 297-2122
EI. 355 Lexington Ave., 15th Floor <a href="http://www.buildershardware.com">www.buildershardware.com</a>	
EJ. New York, NY 10017	
EK. Brick Institute of America	(703) 620-0010
EL. 1850 Centennial Park Dr., #301	<a href="http://www.bia.org">www.bia.org</a>
EM. Reston, VA 20191	
EN. Compressed Air and Gas Institute	(216) 241-7333
EO. 1300 Sumner Ave.	<a href="http://www.cagi.org">www.cagi.org</a>
EP. Cleveland, OH 44115-2851	

EQ. Copper Development Association	(212) 251-7200
260 Madison Avenue, 16th Floor	
<a href="http://www.copper.org">www.copper.org</a>	
ER. New York, NY 10016	
ES. Chemical Fabrics and Film Association	(216) 241-7333
1300 Sumner Avenue	
<a href="http://www.chemicalfabricsandfilm.com">www.chemicalfabricsandfilm.com</a>	
ET. Cleveland, Ohio 44115-2851	
EU. Compressed Gas Association	(703) 788-2700
EV. 4221 Walney Road, 5th Floor	
<a href="http://www.cganet.com">www.cganet.com</a>	
EW. Chantilly, VA 20151	
EX. Ceilings & Interior Systems Construction Association	(630) 584-1919
EY. 405 Illinois Avenue, Unit 2B	<a href="http://cisca.org">http://cisca.org</a>
EZ. St. Charles, IL 60174	
FA. Cast Iron Soil Pipe Institute	(423) 892-0137
FB. 5959 Shallowford Rd., Suite 419	<a href="http://www.cispi.org">www.cispi.org</a>
FC. Chattanooga, TN 37421	
FD. Chain Link Fence Manufacturers Institute	(301) 596-2583
FE. 10015 Old Columbia Road, Suite B-215	<a href="http://CLFMI">CLFMI</a>
FF. Columbia, MD 21046	
FG. CPA/CWC Composite Panel Association/Composite Wood Council	
(703) 724-1128	
FH. 10465 Deerfield Avenue, Suite 306	
<a href="http://www.pbmdf.com">www.pbmdf.com</a>	
FI. Leesburg, VA 20176	
FJ. Corrugated Polyethylene Pipe Association	
(800) 510-2772	
FK. 432 N. Superior St.	(419) 241-2221
FL. Toledo, OH 43604	
FM. U.S. Consumer Product Safety Commission	
(301) 504-7923	
FN. 4330 East West Highway	<a href="http://www.cpsc.gov">www.cpsc.gov</a>
FO. Bethesda, MD 20814	
FP. Carpet and Rug Institute	(706) 278-3176
FQ. 730 College Drive	<a href="http://www.carpet-rug.com">www.carpet-rug.com</a>
FR. Dalton, GA 30720	
FS. Concrete Reinforcing Steel Institute	(847) 517-1200
FT. 933 N. Plum Grove Rd.	(800) 328-6306
FU. Schaumburg, IL 60173-4758	<a href="http://www.crsi.org">www.crsi.org</a>
FV. Canadian Standards Association	(416) 747-4000
FW. 5060 Spectrum Way	<a href="http://www.csa.ca">www.csa.ca</a>
FX. Mississauga, Ontario L4W 5N6 Canada	
FY. Cast Stone Institute	(717) 272-3744

FZ. 813 Chestnut Street, PO Box 68 <a href="http://www.caststone.org">www.caststone.org</a>	
GA. Lebanon, PA 17042	
GB. Cedar Shake & Shingle Bureau	(604) 820-7700
GC. #2 - 7101 Horne Street	<a href="http://www.cedarbureau.org">www.cedarbureau.org</a>
GD. Mission, BC V2V 7A2 Canada	
GE. Ceramic Tile Institute of America	(310) 574-7800
GF. 12061 West Jefferson Blvd.	<a href="http://www.ctioa.org">www.ctioa.org</a>
GG. Culver City, CA 90230-6219	
GH. Door and Hardware Institute	(703) 222-2010
GI. (Formerly: National Builders Hardware Association)	<a href="http://www.dhi.org">www.dhi.org</a>
GJ. 14150 Newbrook Dr.	
GK. Chantilly, VA20151	
GL. Ductile Iron Pipe Research Association	(205) 402-8700
GM. 245 Riverchase Pkwy East, Suite O	<a href="http://www.dipra.org">www.dipra.org</a>
GN. Birmingham, AL 35244	
GO. EIA/TIA EIA/TIA Standards and Technology (703) 907-8024	
GP. 2500 Wilson Blvd.	<a href="http://www.eia.org">www.eia.org</a>
GQ. Arlington, VA 22201	
GR. EIFS Industry Members Association	(800) 294-3462
GS. 3000 Corporate center Drive, #270	<a href="http://www.eima.com">www.eima.com</a>
GT. Morrow, GA 30260	
GU. Expansion Joint Manufacturers Association (914) 332-0040	
GV. 25 N. Broadway	<a href="http://www.ejma.org">www.ejma.org</a>
GW. Tarrytown, NY 10591	
GX. Fluid Controls Institute	(216) 241-7333
GY. 1300 Sumner Ave. <a href="http://www.fluidcontrolsinstitute.org">www.fluidcontrolsinstitute.org</a>	
GZ. Cleveland, OH 441 15-2851	
HA. The Flooring Contractors Association	(248) 661-5015
HB. 7439 Millwood Drive	<a href="http://www.fcica.com">www.fcica.com</a>
HC. West Bloomfield, MI 48322	
HD. Factory Mutual Research Corporation	(781) 762-4300
HE. 1151 Boston-Providence Turnpike <a href="http://www.fmglobal.com">www.fmglobal.com</a>	
HF. P.O. Box 9102	
HG. Norwood, MA 02062-9102	
HH. FM Global	(401) 275-3000
HI. Factory Mutual Insurance Company <a href="http://www.fmglobal.com">www.fmglobal.com</a>	
HJ. 1301 Atwood Avenue	

HK. P O Box 7500  
 HL. Johnston, RI 02919  
 HM. Gypsum Association (301) 277-8686  
 HN. 6525 Belcrest Road #480 [www.gypsum.org](http://www.gypsum.org)  
 HO. Hyattsville, MD 20782  
 HP. Glass Association of North America (785) 271-0208  
 HQ. 2945 SW Wanamaker Drive, Suite A  
     [www.glasswebsite.com](http://www.glasswebsite.com)  
 HR. Topeka, KS 66614  
 HS. Hydraulic Institute (973) 267-9700  
 HT. 6 Campus Drive, First Floor North  
     [www.pumps.org](http://www.pumps.org)  
 HU. Pusippuny, NJ 07054  
 HV. Hydronics Institute (merged with AHRI 2008)  
     (908) 464-8200  
 HW. (Division of Gas Appliance Manufacturers Association)  
     [Hydronics Institute](http://Hydronics Institute)  
 HX. 2111 Wilson Blvd., Suite 500  
 HY. Arlington, VA 22201  
 HZ. Hardwood Manufacturers Association (800)  
     373-WOOD (9663)  
 IA. (Formerly: Southern Hardwood Lumber)  
     [www.hardwood.org](http://www.hardwood.org)  
 IB. Manufacturers Association)  
 IC. 400 Penn Center Blvd., Suite 530  
 ID. Pittsburgh, PA 15235-5605  
 IE. Hardwood Plywood and Veneer Association  
     (703) 435-2900  
 IF. 1825 Michael Farraday Dr. [www.hpva.org](http://www.hpva.org)  
 IG. Reston, VA 20190  
 IH. International Code Council (888) 422-7233  
 II. 500 New Jersey Avenue, NW, 6th Floor  
     [www.iccsafe.org](http://www.iccsafe.org)  
 IJ. Washington, DC 20001-2070  
 IK. ICC-ES International Council Evaluation Service Inc.  
     (562) 699-0543  
 IL. 5360 Workman Mill Road [www.icc-es.org](http://www.icc-es.org)  
 IM. Whittier, CA 90601  
 IN. International Erosion Control Association (800) 455-4322  
 IO. 3401 Quebec St, Suite 3500 [www.ieca.org](http://www.ieca.org)  
 IP. Denver, CO 80207  
 IQ. Insulated Cable Engineers Association, Inc.  
     (770) 830-0369  
 IR. P.O. Box 1569 [www.icea.net](http://www.icea.net)



IS. Carrollton, GA 30117	
IT. International Concrete Repair Institute	(847) 827-0830
IU. 3166 S. River Road, Suite 132	<a href="http://www.icri.org">www.icri.org</a>
IV. Des Plaines, IL 60018	
IW. Institute of Electrical and Electronics Engineers	(800) 678-4333
IX. 3 Park Avenue, 17th Floor	(212) 419-7900
IY. New York, NY 10016	<a href="http://www.ieee.org">www.ieee.org</a>
IZ. Illuminating Engineering Society of North America	(212) 248-5000
JA. 120 Wall St., 17th Floor	<a href="http://www.iesna.org">www.iesna.org</a>
JB. New York, NY 10005-4001	
JC. Insulating Glass Certification Council, Inc. (315) 646-2234	
JD. P O Box 730	<a href="http://www.igcc.org">www.igcc.org</a>
JE. Sackets Harbor, NY 13685	
JF. Insulating Glass Manufacturers Alliance	(613) 233-1510
JG. 27 N. Wacker Drive, Suite 365 <a href="http://www.igmaonline.org">www.igmaonline.org</a>	
JH. Chicago, IL 60606-2800	
JI. International Interior Design Association	(888) 799-4432
JJ. 222 Merchandise Mart, Suite 567	<a href="http://www.iida.com">www.iida.com</a>
JK. Chicago, IL 60654	
JL. Indiana Limestone Institute of America	<a href="http://www.iliai.com">www.iliai.com</a>
JM. Institute of Noise Control Engineering of the USA	(317) 735-4063
JN. 9100 Purdue Road, Suite 200 <a href="http://www.inceusa.org">www.inceusa.org</a>	
JO. Indianapolis, IN 46268	
JP. ISA - International Society for Measurement (919) 549-8411	
JQ. and Control	<a href="http://www.isa.org">www.isa.org</a>
JR. 67 Alexander Dr.	
JS. Research Triangle Park, NC 27709	
JT. International Organization for Standardization +41 22 749 01 11	
JU. 1 ch. De la Voie-Creuse	<a href="http://www.iso.org">www.iso.org</a>
JV. Case Postale 56	
JW. CH-1211 Geneva 20, Switzerland	
JX. International Solid Surface Fabricators Association	(877) 464-7732
JY. 910 W. State Street, Unit 1	<a href="http://www.issfa.com">www.issfa.com</a>
JZ. Lehi, UT 84043	
KA. Intelligent Transportation Systems	(800) 853-1351
KB. Research and Innovative Technology Administration (RITA)	<a href="http://www.its.dot.gov">www.its.dot.gov</a>
KC. 1200 New Jersey Avenue, S.E	
KD. Washington, DC 20590	

KE. International Window Film Association	(276) 666-4932
KF. <a href="http://www.iwfa.com">www.iwfa.com</a>	
KG. Association for Iron & Steel Technology	(724) 814-3000
KH. (Formerly: Iron and Steel Society)	<a href="http://www.iss.org">www.iss.org</a>
KI. 186 Thorn Hill Road	
KJ. Warrendale, PA 15086-7512	
KK. Kitchen Cabinet Manufacturers Association (703) 264-1690	
KL. (Formerly: National Kitchen Cabinet Association)	<a href="http://www.kcma.org">www.kcma.org</a>
KM. 1899 Preston White Dr.	
KN. Reston, VA 22091-4326	
KO. Light Gage Structural Institute	(972) 625-4560
KP. c/o Loseke Technologies, Inc. <a href="http://www.loseke.com/lgsi.html">www.loseke.com/lgsi.html</a>	
KQ. P.O. Box 560746	
KR. The Colony, TX 75056	
KS. Laminating Materials Association	
KT. (Formerly: American Laminators Association)	
KU. 116 Lawrence St.	
KV. Hillsdale, NJ 07642-2730	
KW. The Lightning Protection Institute	(800) 488-6864
KX. P.O. Box 99	<a href="http://www.lightning.org">www.lightning.org</a>
KY. Maryville, MO 64468	
KZ. Metal Building Manufacturer's Association (216) 241-7333	
LA. 1300 Sumner Ave.	<a href="http://www.mbma.com">www.mbma.com</a>
LB. Cleveland, OH 441158-2851	
LC. Mechanical Contractors Association of America	(301) 869-5800
LD. 1385 Piccud Dr.	<a href="http://www.mcaa.org">www.mcaa.org</a>
LE. Rockville, MD 20850	
LF. Metal Framing Manufacturers Association (312) 644-6610	
LG. 401 N. Michigan Ave.	<a href="http://www.metalframingmfg.org">www.metalframingmfg.org</a>
LH. Chicago, IL 60611	
LI. Marble Institute of America	(440) 250-9222
LJ. 28901 Clemens Road, Suite 100 <a href="http://www.marble-institute.com">www.marble-institute.com</a>	
LK. Cleveland, OH 44145	
LL. Masonry Institute of America	(800) 221-4000
LM. 22815 Frampton Avenue	<a href="http://www.masonryinstitute.org">www.masonryinstitute.org</a>
LN. Torrence, CA 90501	
LO. Material Handling Industry of America	(704) 676-1190
LP. 8720 Red Oak Blvd, Suite 201	<a href="http://www.mhia.org">www.mhia.org</a>

LQ. Charlotte, NC 28217-3992  
 LR. ML/SFA Metal Lath/Steel Framing Association  
 (312) 456-5590  
 LS. (A Division of the NAAMM)  
 LT. 8 South Michigan Ave., Suite 1000  
 LU. Chicago, IL 60603  
 LV. Master Painters Institute (604) 298-7578  
 LW. [www.paintinfo.com](http://www.paintinfo.com)  
 LX. Manufacturers Standardization Society (703) 281-6613  
 LY. of the Valve and Fittings Industry [mss-hq.org](http://mss-hq.org)  
 LZ. 127 Park St., NE  
 MA. Vienna, VA 22180  
 MB. National Arborist Association (800) 733-2622  
 MC. P.O. Box 1094 (603) 673-3311  
 MD. Amherst, NH 03031-1094  
 ME. National Association of Architectural Metal Manufacturers  
 (630) 942-6591  
 MF. 800 Roosevelt Drive, Bldg C, Suite 312  
[www.naamm.org](http://www.naamm.org)  
 MG. Glen Ellyn, IL 60137  
 MH. North American Insulation Manufacturers Association (703) 684-0084  
 MI. (Formerly: Thermal Insulation Manufacturers Association)  
[www.naima.org](http://www.naima.org)  
 MJ. 44 Canal Center Plaza, Suite 310  
 MK. Alexandria, VA 22314  
 ML. National Asphalt Pavement Association (888) 468-6499  
 MM. NAPA Building [www.hotmix.org](http://www.hotmix.org)  
 MN. 5100 Forbes Blvd.  
 MO. Lanham, MD 20706-4413  
 MP. Electronic Life Safety, Security & Systems Professionals  
 (888) 447-1689  
 MQ. (Formerly: National Burglar & Fire Alarm Association) [www.alarm.org](http://www.alarm.org)  
 MR. 2300 Valley View Lane Suite 230  
 MS. Irving, TX 75062  
 MT. National Building Granite Quarries Association Inc. (800) 557-2848  
 MU. 1220 L. Street, N.W., Suite 100-167  
[www.nbgqa.com](http://www.nbgqa.com)  
 MV. Washington, DC 20005  
 MW. National Collegiate Athletic Association  
 (317) 917-6222 700 W. Washington Street  
[www.ncaa.org](http://www.ncaa.org)  
 MX. Indianapolis, IN 46206  
 MY. National Concrete Masonry Association (703) 713-1900  
 MZ. 13750 Sunrise Valley Drive [www.ncma.org](http://www.ncma.org)

NA. Herndon, VA 20171  
 NB. National Ready Mixed Concrete Association  
 (888) 846-7622  
 NC. 900 Spring Street [www.nrmca.org](http://www.nrmca.org)  
 ND. Silver Spring, MD 20910  
 NE. National Corrugated Steel Pipe Association  
 (972) 850-1907  
 NF. 14070 Proton Road, Suite 100 LB9 [www.ncspa.org](http://www.ncspa.org)  
 NG. Dallas, TX 75244  
 NH. National Environmental Balancing Bureau  
 (301) 977-3698  
 NI. 8575 Grovemont Circle [www.nebb.org](http://www.nebb.org)  
 NJ. Gaithersburg, MD 20877-4121  
 NK. National Electrical Contractors Association  
 (301) 657-3110  
 NL. 3 Bethesda Metro Center, Suite 1100  
[www.necanet.org](http://www.necanet.org)  
 NM. Bethesda, MD 20814-5372  
 NN. National Elevator Industry, Inc. (518) 854-3100  
 NO. P.O. Box 838 [www.neii.org](http://www.neii.org)  
 NP. Salem, NY 12865-0838  
 NQ. Northeastern Lumber Manufacturers Association (207) 829-6901  
 NR. 272 Tuttle Rd. [www.nelma.org](http://www.nelma.org)  
 NS. P.O. Box 87A  
 NT. Cumberland Center, ME 04021  
 NU. The Association of and Medical Imaging Equipment Manufacturers (703) 841-3200  
 NV. 1300 N 17th St., Suite 1752 [www.nema.org](http://www.nema.org)  
 NW. Rosslyn, VA 22209  
 NX. National Fire Protection Association (800) 344-3555  
 NY. One Batterymarch Park (617) 770 3000  
 NZ. P.O. Box 9101 <http://www.nfpa.org>  
 OA. Quincy, MA 02269-9101  
 OB. National Fenestration Rating Council (301) 589-1776  
 OC. 6305 Ivy Lane, Suite 140 [www.nfrc.org](http://www.nfrc.org)  
 OD. Greenbelt, MD 20770  
 OE. NFSHSA National Federation of State High School Association  
 (317) 972-6900  
 OF. PO Box 690 <http://nfshsa.org/>  
 OG. Indianapolis, IN 46206  
 OH. NSF International (800) 673-6275  
 OI. PO Box 130140 [www.nsf.org](http://www.nsf.org)  
 OJ. 789 N. Dixboro Road  
 OK. Ann Arbor, MI 48113

OL. National Floor Safety Institute	(817) 749-1700
OM. P.O. Box 92607	<a href="http://www.nfsi.org">www.nfsi.org</a>
ON. Southlake, TX 76092	
OO. National Hardwood Lumber Association	(901) 377-1818
OP. P.O. Box 34518	<a href="http://www.natlhardwood.org">www.natlhardwood.org</a>
OQ. Memphis, TN 38184-0518	
OR. National Glass Association	(866) 342-5642
OS. 8200 Greensboro Drive, Suite 302	<a href="http://www.glass.org">www.glass.org</a>
OT. McLean, VA 22102-3881	
OU. National Lumber Grades Authority	(604) 524-2393
OV. #302-960 Quayside Dr.	<a href="http://www.nlga.org">www.nlga.org</a>
OW. New Westminster, BC V3M 6G2	
OX. Composite Panel Association	(703) 724-1128
OY. (Formerly: National Particleboard Association)	
<a href="http://www.pbmdf.com">www.pbmdf.com</a>	
OZ. 19465 Deerfield Avenue, Suite 306	
PA. Leesburg, VA 20176	
PB. National Paint and Coatings Association	(202) 462-6272
PC. 1500 Rhode Island Ave., NW	<a href="http://www.paint.org">www.paint.org</a>
PD. Washington, DC 20005-5597	
PE. National Roofing Contractors Association	(847) 299-9070
PF. O'Hare International Center	<a href="http://www.nrca.net">www.nrca.net</a>
PG. 10255 W. Higgins Rd., Suite 600	
PH. Rosemont, IL 60018-5607	
PI. National Ready Mixed Concrete Association	
(301) 587-1400	
PJ. 900 Spring St.	<a href="http://www.nrmca.org">www.nrmca.org</a>
PK. Silver Spring, MD 20910	
PL. NSF International	(734) 769-8010
PM. (Formerly: National Sanitation Foundation)	
<a href="http://www.nsf.org">www.nsf.org</a>	
PN. P.O. Box 130140	
PO. Ann Arbor, MI 48113-0140	
PP. The National Terrazzo & Mosaic Association, Inc.	(800) 323-9736
PQ. 201 North Maple, Suite 208	<a href="http://www.ntma.com">www.ntma.com</a>
PR. Purcellville, VA 20132	
PS. National Uniform Seismic Installation Guidelines	(510) 946-0135
PT. 12 Lahoma Ct.	
PU. Alamo, CA 94526	
PV. National Wood Flooring Association	(800) 422-4556
PW. 111 Chesterfield Industrial Boulevard	
<a href="http://woodfloors.org/">http://woodfloors.org/</a>	
PX. Chesterfield, MO 63005	

PY. National Wood Window and Door Association  
(800) 223-2301

PZ. (Formerly: National Woodwork Manuf. Association)  
[www.nwwda.org/](http://www.nwwda.org/)

QA. 401 N. Michigan Avenue, Suite 2200

QB. Chicago, IL 60611

QC. Ohio Department of Natural Resources (614) 265-6300

**1.04 2045 MORSE ROAD, BUILDING G**  
**WWW.DNR.STATE.OH.US**

**1.05 COLUMBUS, OH 43229-6693**

A. Portland Cement Association (847) 966-6200

B. 5420 Old Orchard Rd. [www.cement.org](http://www.cement.org)

C. Skokie, IL 60077-1083

D. Precast/Prestressed Concrete Institute (312) 786-0300

E. 209 W. Jackson Blvd. #500 [www.pci.org](http://www.pci.org)

F. Chicago, IL 60606

G. Painting and Decorating Contractors of America (800) 332-7322

H. 1801 Park 270 Drive, Suite 220 [www.pdca.com](http://www.pdca.com)

I. St. Louis, MO 63146

J. Plumbing and Drainage Institute (800) 589-8956

K. 800 Turnpike St., Suite 300 [www.pdionline.org](http://www.pdionline.org)

L. North Andover, MA 01845

M. Porcelain Enamel Institute (770) 676-9366

N. P.O. Box 90220 [www.porcelainenamel.com](http://www.porcelainenamel.com)

O. Norcross, GA 30010

P. Plastic Pipe and Fittings Association (630) 858-6540

Q. 800 Roosevelt Rd., Building C, Suite 312  
[www.ppfahome.org](http://www.ppfahome.org)

R. Glen Ellyn, IL 60137-5833

S. Plastic Pipe Institute (469) 499-1044

T. (The Society of the Plastics Industry, Inc.)  
[www.plasticpipe.org](http://www.plasticpipe.org)

U. 105 Decker Court, Suite 825

V. Irving, TX 75062

W. Research Council on Structural Connections  
[www.boltcouncil.org](http://www.boltcouncil.org)

X. Resilient Floor Covering Institute (706) 882-3833

Y. 115 Broad Street, Suite 201 [www.rfci.com](http://www.rfci.com)

Z. LaGrange, GA 30240

AA. Rubber Manufacturers Association (800) 220-7620

AB. 1400 K St., NW, Suite 900 (202) 682-4800

AC. Washington, DC 20005 [www.rma.org](http://www.rma.org)

AD. SAE International (877) 606-7323

AE. 400 Commonwealth Dr.	<a href="http://www.sae.org">www.sae.org</a>
AF. Warrendale, PA 15096-0001	
AG. For publications: Call (412) 776-4970	
AH. Steel Door Institute	(440) 889-0010
AI. 30200 Detroit Rd.	<a href="http://www.steeldoor.org">www.steeldoor.org</a>
AJ. Cleveland, OH 44145-1967	
AK. Southern Hardwood Lumber Manufacturers Association	
AL. (See HMA)	
AM. Sealed Insulating Glass Manufacturers Association	(312) 644-6610
AN. 401 N. Michigan Ave. Suite 2400	
AO. Chicago, IL 60611-4267	
AP. Safety Glazing Certification Council	(315) 646-2234
AQ. PO Box 730	<a href="http://www.sgcc.org">www.sgcc.org</a>
AR. Sackets Harbor, NY 13685	
AS. Steel Joist institute	(843) 293-1995
AT. 196 Stonebridge Drive, Unit 1	
<a href="http://www.steeljoist.org">www.steeljoist.org</a>	
AU. Myrtle Beach, SC 29588	
AV. Screen Manufacturers Association	
<a href="http://www.smainfo.org">www.smainfo.org</a>	
AW. SMACNA Sheet Metal and Air Conditioning	
(703) 803-2980	
AX. Contractors' National Association, Inc.	
<a href="http://www.smacna.org">www.smacna.org</a>	
AY. 4201 Lafayette Center Dr.	
AZ. P.O. Box 221230	
BA. Chantilly, VA 20151-1209	
BB. Society of Motion Picture and Television Engineers	(914) 761-1100
BC. 3 Barker Ave., 5th Floor	<a href="http://www.smppte.org">www.smppte.org</a>
BD. White Plains, NY 10601	
BE. Southern Pine Inspection Bureau	(850) 434-2611
BF. P.O. Box 10915	<a href="http://www.spib.org">www.spib.org</a>
BG. Pensacola, FL 32524-0915	
BH. Single Ply Roofing Industry	(781) 647-7026
BI. 411 Waverly Oaks Road, 331B	<a href="http://www.spri.org">www.spri.org</a>
BJ. Waltham, MA 02452	
BK. The Society for Protective Coatings	(412) 281-2331
BL. 40 24th St., 6th Floor	(877) 281-7772
BM. Pittsburgh, PA 15222-4643	<a href="http://www.sspc.org">www.sspc.org</a>
BN. Sealant, Waterproofing and Restoration Institute	(816) 472-7974
BO. 400 Admiral Blvd.	<a href="http://www.swrionline.org">www.swrionline.org</a>
BP. Kansas City, MO 64106	
BQ. Tree Care Industry Association	(800) 733-2622

BR. 136 Harvey Road, Suite 101	<a href="http://www.treecareindustry.org">www.treecareindustry.org</a>
BS. Londonderry, NH 03053	
BT. Tile Council of North America, Inc.	(864) 646-8453
BU. 100 Clemson Rescue Blvd.	<a href="http://www.tileusa.com">www.tileusa.com</a>
BV. Anderson, SC 29625	
BW. Texas Forest Service	(979) 458-6606
BX. John B. Connally Building, Suite 364 Service (TFS)	<a href="http://TexasForest.org">Texas Forest</a>
BY. 301 Tarrow Street	
BZ. College Station, TX 77840-7896	
CA. Truss Plate Institute	(703) 683-1010
CB. 218 N. Lee St, #312	<a href="http://www.tpinst.org">www.tpinst.org</a>
CC. Alexandria, VA 22314	
CD. Tile Roofing Institute	(312) 670-4177
CE. 230 East Ohio St., Suite 400 <a href="http://www.tilerroofing.org">www.tilerroofing.org</a>	
CF. Chicago, IL 60611	
CG. Underwriters Laboratories Inc.	(877) 854-3577
CH. 2600 N.W. Lake Road	<a href="http://www.ul.com">www.ul.com</a>
CI. Camas, WA 98607	
CJ. Volumetric Mixer Manufacturers Bureau	(301) 587-1400
CK. 900 Spring Street	<a href="http://vmmb.org/">http://vmmb.org/</a>
CL. Silver Spring, MD 20910	
CM. Wallcoverings Association	(312) 644-6610
CN. 401 N. Michigan Ave. Suite 2200 <a href="http://www.wallcoverings.org">www.wallcoverings.org</a>	
CO. Chicago, IL 60611-4267	
CP. West Coast Lumber Inspection Bureau	(503) 639-0651
CQ. P.O. Box 23145	<a href="http://www.wclib.org">www.wclib.org</a>
CR. Portland, OR 97281-3145	
CS. Window Covering Safety Council 355 Lexington Avenue, Suite 1500 <a href="http://www.windowcoverings.org">www.windowcoverings.org</a>	(212) 297-2100
CT. New York, NY 10017	
CU. Window & Door Manufacturers Association (800) 223-2301	
CV. 401 N. Michigan Avenue, Suite 220 <a href="http://www.wdma.com">www.wdma.com</a>	
CW. Chicago, IL 60611	
CX. Warnock Hersey	<a href="http://www.intertek-etlsemko.com">www.intertek-etlsemko.com</a>
CY. Western Red Cedar Lumber Association	(604) 684-0266
CZ. 1501-700 West Pender Street	<a href="http://www.wrcla.org">www.wrcla.org</a>
DA. Pender Place 1, Business Building	



DB. Vancouver, B.C., Canada V6C 1G8	
DC. Western Wood Products Association	(503) 224-3930
DD. 522 SW 5th Ave.	<a href="http://www.wwpa.org">www.wwpa.org</a>
DE. Portland, OR 97204-2122	
DF. FEDERAL GOVERNMENT AGENCIES:	
DG. U.S. Department of Justice	(202) 307-0663
DH. 950 Pennsylvania Avenue, NW	<a href="http://www.ada.gov">www.ada.gov</a>
DI. Civil Rights Division	
DJ. Disability Rights Section - NYA	
DK. Washington, D.C. 20530	
DL. United States Access Board	(800) 872-2253
DM. 1331 F Street, NW, Suite 1000	
<a href="http://www.access-board.gov">www.access-board.gov</a>	
DN. Washington, D.C. 20004-1111	
DO. Code of Federal Regulations	(866) 512-1800
DP. U.S. Government Printing Office	
<a href="http://www.gpoaccess.gov/ecfr">www.gpoaccess.gov/ecfr</a>	
DQ. Mail Stop: IDCC	
DR. 732 N. Capitol Street, NW	
DS. Washington, DC 20401	
DT. U.S. Consumer Product Safety Commission	
(301) 504-7906	
DU. East West Towers	<a href="http://www.cpsc.gov">www.cpsc.gov</a>
DV. 4330 East-West Hwy	
DW. Bethesda, MD 20814	
DX. U.S. Department of Commerce	(202) 482-2000
DY. 1401 Constitution Ave., NW	<a href="http://www.commerce.gov">www.commerce.gov</a>
DZ. Washington, DC 20230	
EA. U.S. Department of Transportation	(202) 366-4000
EB. 1200 New Jersey Avenue SE	<a href="http://www.dot.gov">www.dot.gov</a>
EC. Washington, DC 20590	
ED. U.S. Environmental Protection Agency	(202) 272-0167
EE. Ariel Rios Building	<a href="http://www.epa.gov">www.epa.gov</a>
EF. 1200 Pennsylvania Avenue, N.W.	
EG. Washington, DC 20460	
EH. U.S. Food and Drug Administration	(856) 810-7331
EI. GMP Publications, Inc.	<a href="http://www.fda.com">www.fda.com</a>
EJ. P.O. Box 335	
EK. Medford, NJ 08055	
EL. Federal Highway Administration	(202) 366-4000
EM. U.S. Department of Transportation	
<a href="http://www.fhwa.dot.gov">www.fhwa.dot.gov</a>	
EN. 1200 New Jersey Ave., SE	

EO. Washington, DC 20590	
EP. General Services Administration	(703) 605-2567
EQ. Federal Supply Service	<a href="http://apps.fss.gsa.gov">http://apps.fss.gsa.gov</a>
ER. FSS Product Acquisition Center	
ES. Supply Standards Division (FLAS	
ET. Arlington, VA 22202	
EU. Federal Trade Commission	(202) 326-2222
EV. 600 Pennsylvania Ave., NW	<a href="http://www.ftc.gov">www.ftc.gov</a>
EW. Washington, DC 20580	
EX. U.S. General Services Administration	(800) 488-3111
EY. 1800 F Street NW	<a href="http://www.gsa.gov">www.gsa.gov</a>
EZ. Washington, DC 20405	
FA. U.S. Department of Housing and Urban Development	(202) 708-1112
FB. 451 7th Street, S.W.	<a href="http://www.hud.gov">www.hud.gov</a>
FC. Washington, DC 20410	
FD. The National Environmental Policy Act	(202) 564-7157
FE. U.S. Environmental Protection Agency	<a href="http://www.epa.gov">www.epa.gov</a>
FF. 1200 Pennsylvania Ave., NW	
FG. Washington, D.C. 20460-0001	
FH. National Institute of Standards and Technology	(301 ) 975-6487
FI. (U.S. Department of Commerce)	<a href="http://www.nist.gov">www.nist.gov</a>
FJ. 100 Bureau Dr., Stop 1070	
FK. Gaithersburg, MD 20899-1070	
FL. National Ready Mix Concrete Association (888) 846-7622	
FM. 900 Spring Street	<a href="http://www.nrmca.org">www.nrmca.org</a>
FN. Silver Spring, MD 20910	
FO. Occupational Safety and Health Administration	(800) 321-6742
FP. (U.S. Department of Labor)	<a href="http://www.osha.gov">www.osha.gov</a>
FQ. 200 Constitution Ave., NW	
FR. Washington, DC 20210	
FS. Product Standard of NBS	(202) 512-1800
FT. (U.S. Department of Commerce)	
FU. Government Printing Office	
FV. Washington, DC 20402	
FW. U.S. Department of Agriculture	(202) 456-1111
FX. 1400 Independence Ave., SW	<a href="http://www.usda.gov">www.usda.gov</a>
FY. Washington, DC 20250	

**PRODUCTS**

**2.01 NOT USED**

**EXECUTION**

**3.01 NOT USED**

**END OF SECTION**

**SECTION 01 45 00**  
**QUALITY CONTROL**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. References
  - 2. Quality Assurance
    - a. Testing Laboratory Qualifications
    - b. Control of Installation
  - 3. Tolerances
  - 4. Inspection and Testing Laboratory Services
  - 5. Manufacturers' Field Services and Reports
- B. Related Sections:
  - 1. Information Available to Bidders: Soil investigation data.
  - 2. General Conditions: Inspections, testing, and approvals required by public authorities.
  - 3. Section 01 33 00 (01330) - Submittals and Substitutions: Submission of manufacturers' instructions and certificates.
  - 4. Section 01 60 00 (01600) - Material and Equipment: Requirements for material and product quality.
  - 5. Section 01 77 00 (01770) - Contract Closeout: Project Record Documents.
  - 6. Individual Specification Sections: Inspections and tests required, and standards for testing.

**1.02 REFERENCES**

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Architect shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.
- E. ASTM International Publications:
  - 1. C802 - Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction.
  - 2. C1021 - Practice for Laboratories Engaged in the Testing of Building Sealants.
  - 3. C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
  - 4. C1093 - Practice for Accreditation of Testing Agencies for Unit Masonry.
  - 5. D290 - Recommended Practice for Bituminous Mixing Plant Inspection.
  - 6. D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
  - 7. D4561 - Practice for Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.
  - 8. E329 - Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.
  - 9. E543 - Practice for Determining the Qualification of Nondestructive Testing Agencies.
  - 10. E699 - Practice for Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

### **1.03 SUBMITTALS**

- A. Before start of the Work, submit testing firm name, address, and telephone number and names of full time registered Engineers, specialists, and responsible officer.
- B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

### **1.04 QUALITY ASSURANCE**

- A. Testing Laboratory Qualifications:
  - 1. Comply with requirements of ASTM Publications C802, C1021, C1077, C1093, D290, D3740, D4561, E329, E543, and E699.
  - 2. Laboratory: Authorized to operate in State in which Project is located.
  - 3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
  - 4. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
- B. Control of Installation:
  - 1. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
  - 2. Comply with manufacturers' instructions, including each step in sequence.
  - 3. Should manufacturers' instructions conflict with Contract Documents, request clarification from [Architect] [Owner's Representative] before proceeding.
  - 4. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
  - 5. Perform work by persons qualified to produce workmanship of specified quality.
  - 6. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

### **1.05 TOLERANCES**

- A. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from the [Architect] [Owner's Representative] before proceeding.
- C. Adjust products to appropriate dimensions; position before securing Products in place.

### **1.06 INSPECTING AND TESTING LABORATORY SERVICES**

- A. Except as otherwise required in the Owner-Contractor Agreement, the Contractor shall appoint, employ, and pay for specified services of an independent firm to perform inspecting and testing, subject to approval of the Owner [and Architect].
  - 1. Refer to General Conditions, Articles 5 and 26, for additional requirements.
- B. Employment of testing laboratory in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. The testing firm will perform inspections, tests, and other services specified in individual specification sections and as required by the [Architect] [Owner's Representative].
- D. Inspecting, testing, and source quality control may occur on or off the project site.
- E. Retesting required because of non-conformance to specified requirements shall be performed by the same testing firm on instructions by the [Architect] [Owner's Representative].
- F. Laboratory Responsibilities:
  - 1. Test samples of mixes submitted by Contractor.
  - 2. Provide qualified personnel at site. Cooperate with [Architect] [Owner's Representative] and Contractor in performance of services.

3. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.
  4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  5. Promptly notify [Architect] [Owner's Representative] and Contractor of observed irregularities or non-conformance of Work or Products.
  6. Perform additional inspection and tests required by the [Architect] [Owner's Representative].
  7. Attend preconstruction meetings and progress meetings.
- G. Laboratory Reports: After each inspection and test, promptly submit copies of laboratory report to the [Architect] [Owner's Representative] and Contractor. Include the following:
1. Date issued
  2. Project title and number
  3. Name of inspector
  4. Date and time of sampling or inspection
  5. Identification of product and specifications section
  6. Location in the Project
  7. Type of inspection or test
  8. Date of test
  9. Results of tests
  10. Conformance with Contract Documents
  11. When requested by [Architect] [Owner's Representative], provide interpretation of test results
- H. Limits on Testing Laboratory Authority:
1. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  2. Laboratory may not approve or accept any portion of the Work.
  3. Laboratory may not assume any duties of Contractor.
  4. Laboratory has no authority to stop the Work.
- I. Contractor Responsibilities:
1. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
  2. Cooperate with testing firm and personnel, and provide access to the Work. Furnish samples of materials, design mix, equipment, tools, storage, and assistance by incidental labor as requested.
  3. Provide incidental labor and facilities:
    - a. to provide access to Work to be tested
    - b. to obtain and handle samples at the site or at source of Products to be tested
    - c. to facilitate tests and inspections
    - d. to provide storage and curing of test samples
  4. Notify Architect and testing firm 24 hours prior to expected time for operations requiring services.
  5. Make arrangements with testing firm and pay for additional samples and tests required for Contractor's use.
  6. Notify laboratory sufficiently in advance of cancellation of required testing operations. Contractor shall be responsible to laboratory for changes due to failure to notify if requirements for testing are canceled.

#### **1.07 MANUFACTURERS' FIELD SERVICES AND REPORTS**

- A. When specified in individual specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and erection as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

- C. Submit report in duplicate within 15 days of observation to [Architect] [Owner's Representative] for information.

**PRODUCTS**

**2.01 NOT USED**

**EXECUTION**

**3.01 NOT USED**

**END OF SECTION**

**SECTION 01 50 00**  
**TEMPORARY FACILITIES AND CONTROLS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
1. This Section specifies temporary services and facilities, including utilities, construction and support facilities, security and protection. Provide facilities ready for use. Maintain, expand and modify as needed. Remove when no longer needed, or when replaced by permanent facilities.
  2. Work of this Section shall include, but not necessarily be limited to, the following:
    - a. Project/Site Conditions
    - b. Use Charges
    - c. Field Office and Storage Sheds
    - d. Temporary Sanitary Facilities
    - e. Temporary Fire Extinguishers
    - f. Temporary Water
    - g. Temporary Electric Power Service and Interior Lighting
    - h. Temporary Telephone Service and Facsimile Service
    - i. Temporary Storm and Sanitary Sewer
    - j. Temporary Heating, Cooling, and Ventilation
    - k. Temporary Paving
    - l. Temporary Enclosures
    - m. Project Identification
    - n. Temporary Exterior Lighting
    - o. Progress Cleaning and Waste Removal
    - p. Surface and Underground Water Control
    - q. Protection of Installed Work
      - 1) Environmental Protection
      - 2) Dust Control
      - 3) Barriers, Barricades, Warning Signs, and Lights
      - 4) Removal of Construction Facilities and Temporary Controls
- B. Related Sections:
1. General Conditions:
    - a. Refer to General Conditions for additional requirements.
    - b. Section 01 35 00.01 (01000) - Special Requirements
    - c. Section 01 11 00 (01110) - Summary of Work
    - d. Section 01 35 16 - Alteration Project Procedures
    - e. Section 01 56 16 - Temporary Dust Protection
    - f. Section 01 74 00 (01740) - Cleaning and Waste Management
    - g. Section 01 77 00 (01770) - Closeout Procedures
    - h. Section 02 41 19 - Selective Structure Demolition

**1.02 REFERENCES**

- A. American National Standards Institute (ANSI) Publications:
1. A10 "Series standards for "Safety Requirements for Construction and Demolition"
- B. Institute of Electrical and Electronics Engineers (IEEE) Publications:
1. "National Electrical Safety Code (NESC)"
- C. National Electrical Contractors Association (NECA) Publications:
1. Electrical Design Library "Temporary Electrical Facilities."
- D. National Fire Protection Association (NFPA) Publications:
1. 10 "Portable Fire Extinguishers"
  2. 70 "National Electric Code"



3. 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations"

### 1.03 DEFINITIONS

- A. Permanent Enclosure: Permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures, all as determined by the [Architect] [Owner's Representative].

### 1.04 SUBMITTALS

- A. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. The Contractor shall perform the duties under NFPA 241 titled "Owner's Responsibility for Fire Protection."

### 1.05 QUALITY ASSURANCE

- A. Regulations: Each Contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction, including but not limited to:
1. Owner's Requirements
  2. Building Code Requirements
  3. Health and Safety Regulations
  4. Utility Company Regulations
  5. Police, Fire Department, and Rescue Squad Rules
  6. Environmental Protection Regulations
- B. Standards: Comply with NFPA 241, "Standard for Safeguarding Construction, Alterations and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC for industry recommendations.
  2. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions.
  3. Safety and Health Standard: Comply with ANSI/ASSE A10.6.
  4. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

### 1.06 PROJECT/SITE CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates of the implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of the temporary service to use of the permanent service.
1. Temporary Use of Permanent Facilities: The installer of each permanent service or facility shall assume responsibility for its operation, maintenance and protection during its use as a construction service or facility prior to the Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on the site.

### 1.07 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to the Owner or the Architect. Contractor's cost or use charges for temporary services or facilities will not be accepted as a basis of claim for an adjustment in the Contract Sum or Contract Time.

1. Meters: Meters shall be on the Owner's utility systems and shall be furnished and installed by the Subcontractor responsible for respective use charges.
- B. Use of Owner's Existing Utilities: Water and electric power from the Owner's existing systems are available for use without metering and without payment of use charges, subject to the capacity of the Owner's existing systems. Provide connections and extensions of services as required for construction operations.
  1. Conditions of Utility and Systems Use: Use of the Owner's existing systems is subject to the Owner's approval and the capacity of the existing systems. Provide extensions to existing systems as required for construction activities. Where usage exceeds capacity for any reason provide temporary utility connections to nearest originating source.
- C. Other entities using temporary services and facilities include, but are not limited to:
  1. Other Nonprime Contractors
  2. The Owner's Work Forces and Separate Contractors
  3. Occupants of the Project
  4. The Architect
  5. The Owner's Representative
  6. Testing Agencies
  7. Personnel of Government Agencies

## PRODUCTS

### 2.01 MATERIALS

- A. General: Provide new materials; if acceptable to the [Architect] [Owner's Representative], undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Section 06 10 00 - Rough Carpentry.
- C. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire-retardant tarpaulins.
- D. Water: Provide potable water approved by local health authorities.

### 2.02 EQUIPMENT

- A. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
- B. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- C. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- D. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- E. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM Global (FMG), or another recognized trade association related to the type of fuel being consumed.
  1. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.
- F. Temporary Field Office

1. The General Contractor shall provide and maintain clean, temporary weather-tight offices at the site, in location as approved by the Owner, for the use of the Contractor, his Subcontractors' agents, [Owner's Representative], [and] [the Architect], and at which location he or his authorized agent shall be present, or to which either may be readily called at all times. While the work is in progress, copies of permits, approved Shop Drawings, and a complete set of Contract Drawings and Specifications marked up to date with any revisions, shall be kept at said office ready for use at all times.
  - a. Provide sturdy furniture, drawing rack, and drawing display table.
  - b. All expenses in connection with the field office, including the installation cost, and use of heat, light, water, and janitor service shall be borne by the Contractor.
  - c. Field office shall be maintained until final acceptance and then be removed by the Contractor, no later than 15 days after acceptance of building unless the Owner orders earlier removal by them.
- G. Temporary Storage Sheds: Each Subcontractor shall provide and maintain such additional offices, storage sheds, and other temporary buildings or trailers on the project as required for his own use. Location of sheds and trailers shall be located where directed by the Owner's Representative.
- H. Temporary Telephones:
  1. The Contractor shall obtain telephone service to the field office with no cost to the Owner or disruption to Owner's phone service. Cellular Phones will be considered acceptable means of telephone communication to the Owner's Representatives.
  2. The Contractor's superintendent shall maintain and carry on their person a cellular phone at all times during the working day for the duration of the Project. The telephone number shall be supplied to the Owner's Representative and Architect prior to commencement of the Work.
- I. Sanitary Facilities: Toilet rooms within the [new][existing] building shall not be used by construction personnel. Provide sanitary facilities that include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures. Install where facilities will best serve the Project. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used materials.
  1. Toilets: Install self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Use of pit-type privies will not be permitted.
  2. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up. Dispose of drainage properly. Supply cleaning compounds.
  3. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units.
- J. Sanitary Facilities: Use of Owner's existing toilet, wash, and drinking water facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
  1. Where existing toilet, wash and drinking water facilities are out of service due to construction activities, consult with Owner regarding availability of alternative facilities or provide temporary facilities as required.
- K. First Aid Supplies: Comply with governing regulations.
- L. Fire Extinguishers: Provide hand-carried, portable UL-rated, class 'A' fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, class 'ABC' dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
  1. Comply with NFPA 10 and 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

## EXECUTION

### 3.01 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they serve the project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

### 3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
  - 1. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
- B. Water Service:
  - 1. Install water service connected to nearest system, and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
  - 2. Water is to be extended from the Owner's existing water distribution system to a location to be determined by the Contractor, and as approved by Owner.
  - 3. Sterilization: Sterilize temporary water piping prior to use.
  - 4. The Contractor shall remove temporary water service at the completion of the Project.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
  - 1. The Contractor shall connect temporary power to the Owner's existing distribution system as approved by Owner.
  - 2. Temporary work shall be installed in such a manner as not to interfere with the permanent construction. If such interference does occur, it shall be the responsibility of the Contractor to make such changes as may be required to overcome the interference. The cost of these changes will be included as part of the Contract Sum.
    - a. Protect installation against weather damage, the normal operations of other trades, Owner's personnel, and visitors to the site.
    - b. The electrical work for construction purposes shall conform to all Federal and State Specific Safety requirements as well as the requirements of the NFPA 10 "National Electric Code" and IEEE "National Electrical Safety Code (NESC)". The Contractor shall obtain required applications, permits, and inspection pertaining to this work in accordance with the General Conditions.
- D. Temporary Lighting:
  - 1. Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
  - 2. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- E. Sewers and Drainage:
  - 1. If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
  - 2. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.

3. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.
4. The Contractor shall remove temporary sewer and drainage work at the completion of the Project.

### **3.03 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION**

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
  1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Temporary Heat and Ventilation: Provide temporary heat and ventilation required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
  1. The Contractor shall provide heat, supplied with air, as follows:
    - a. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FMG, or another recognized trade association related to the type of fuel being consumed.
    - b. At all times during normal working hours, provide sufficient heat to maintain a temperature of not less than 50 degrees F., and from 40 degrees to 50 degrees F. during periods other than specified herein below.
    - c. At all times during the placing, setting, and curing of concrete, provide sufficient heat to ensure heating of the spaces involved to not less than 50 degrees F.
    - d. Well before gypsum board work begins and continuous throughout the setting and drying periods, a temperature range between 55 and 70 degrees F. shall be maintained day and night. During this period, no finish woodwork, wood finish flooring, resilient flooring or flexible wall coverings shall be installed or stored in the buildings, and no finish painting or applying of finish wall coatings shall be undertaken.
    - e. For a period of ten (10) days previous to the placing of interior wood finish and throughout the placing of this and other interior finishing, varnishing, painting, etc., and until final acceptance of the work or until full occupancy by the Owner, provide sufficient heat to produce a temperature of not less than 70 degrees F.
    - f. Heat and air shall be supplied in a manner which shall avoid the rapid drying of material but thoroughly dry to such an extent that no remaining moisture will affect finish material.
    - g. The Contractor shall operate the heating and ventilating systems each day, including Saturdays, Sundays, and holidays; operating shall include necessary labor and approved operating personnel in attendance as required by agencies having jurisdiction.
    - h. It shall be the Contractor's responsibility to coordinate for the range of temperatures required for temporary heating, during this period, that temperature as recommended by the manufacturer of the materials as mentioned are stored in the building or being installed, and for the length of time recommended, following installation.
    - i. Temporary heating and ventilating equipment, piping, etc., shall be installed in such a manner as not to interfere with work of other trades or the permanent construction. If such interference does occur, it shall be the responsibility of the Contractor to make any changes required to overcome the interference.
    - j. Except as hereinafter specified, the permanent heating and ventilating systems shall not be used for temporary heat. The Contractor shall provide, operate, and maintain heating and ventilating units for the purposes specified. The units shall be arranged to bring in sufficient outdoor air (min. 1-1/2 air changes per hour) to ventilate the

- building and to prevent build-up of harmful dusts and fumes and remove excess moisture, especially to prevent damage to built-up roofing. During warm weather, the Contractor shall provide an adequate supply of fresh air (min. 1-1/2 air changes per hour) when necessary to properly ventilate for moisture, dust, and fumes from paints, cements, or adhesives in tightly enclosed areas where natural ventilation will not be sufficient.
- k. Provide for use and control of existing HVAC system to provide temporary heating and cooling required by construction activities, for curing or drying of completed installations, and for protecting installed construction from adverse effects of low temperatures or high humidity. Provide temporary filters over exhaust and return air openings, and change as required to prevent contamination of ductwork or of main filter systems.
- C. Temporary Paving: Construct and maintain temporary roads and paving to adequately support the indicated loading and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking, where the same permanent facilities will be located. Review proposed modifications to permanent paving with the [Architect] [Owner's Representative].
1. Paving:
    - a. Coordinate development of temporary paving with subgrade grading, compaction, installation, and stabilization of sub-base, and installation of base and finish courses of permanent paving.
- D. Temporary Enclosures: Provide temporary enclosure for protection of construction from exposure, foul weather, other construction operations, and similar activities. Where heat is needed and the building enclosure is incomplete, provide enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions.
1. Temporary building enclosures shall be defined as infills of door, window and skylight openings or other openings in the building exterior with either final glazing, doors and frames, or infilled in a weather tight manner with plywood or other permanent, solid enclosure materials. Plastic film shall not be accepted as permanent enclosure materials in openings. All temporary doors shall be hinged with closures and latches to keep doors shut at all times, so as to maintain temperature control. Determination of building enclosure is by the [Architect] [Owner's Representative] and the Owner, and not subject to Contractor's interpretation. The Contractor will be required to provide temporary enclosures either by walls or partitions at places where there are no permanent wall, entries, curtain walls, etc. to enclose an area.
  2. Installation of finish materials such as insulation, gypsum board, and floor toppings shall not begin until enclosures are made weather-tight and environmental requirements are met for those specific materials.
  3. Maintain required exit ways for protection of life and property,
- E. Project Identification and Temporary Signs:
1. Prepare project identification and other signs of the size indicated; install signs where indicated to inform the public and persons seeking entrance to the project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.
  2. Project Identification signs will not be permitted.
  3. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- F. Temporary Exterior Lighting: Install exterior yard and sign lights so that signs are visible when work is being performed.
- G. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or 3 days when the temperature is expected to rise above 80 degrees F. Handle

hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

- H. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.
- I. Surface and Underground Water Control: Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion. Provide dewatering of site as required.
- J. Temporary Erosion and Sedimentation Control:
  - 1. Contractor shall provide Site erosion control including maintenance of erosion and sedimentation control measures, along with addition of new facilities required by construction for the duration of the project from the Notice to Proceed according to [erosion- and sedimentation-control Drawings] [requirements of the EPA Construction General Permit, or authorities having jurisdiction, whichever is more stringent]. Do not remove erosion control systems until approved by local jurisdictions. Contractor shall keep a daily log of erosion control maintenance. Perform and document weekly inspections and following rain events of sediment control material and maintain if so required
    - a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.

### **3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Except for use of permanent fire protection as soon as available, do not change from use of temporary security and protection facilities to permanent facilities until Substantial Completion.
- B. Fire Protection:
  - 1. General: Follow the fire-prevention plan.
    - a. The Contractor shall appoint one of his personnel who is continually employed on the job site (such as the Superintendent) to additional duty to act as fire warden for this Project. The fire warden shall institute and vigorously enforce a program of fire safety for the Project.
    - b. Until fire protection is supplied by permanent facilities, install and maintain temporary fire protection of types needed to protect against predictable and controllable fire losses. Comply with NFPA 10 "Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
      - 1) Locate fire extinguishers strategically throughout each area where work is in progress.
      - 2) Prohibit smoking in ALL areas of Project, including adjacent exterior areas.
      - 3) Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
      - 4) Store combustible materials in containers in fire-safe locations.
- C. Permanent Fire Protection: At the earliest date, complete installation of the permanent fire protection facility, including connected services, and place into operation. Instruct key personnel on use of facilities.
  - 1. The permanent Fire Protection System shall be operational before any furniture is installed in facility.
- D. Enclosure Fence: Contractor's option, unless otherwise required by the Owner/Contractor Agreement.
- E. Environmental Protection: Operate temporary facilities and conduct construction by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints.

### **3.05 OPERATION**

- A. Enforce strict discipline in use of temporary facilities. Limit availability to intended use to minimize abuse. Maintain facilities in good operating condition until removal.
- B. Protect from damage by freezing temperatures and the elements.
  - 1. Maintain operation of enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour day basis to achieve indicated results and to avoid damage.
  - 2. Prevent piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

### **3.06 TERMINATION AND REMOVAL**

- A. Remove each facility when the need has ended, or replaced by a permanent facility, or no later than Substantial Completion. Complete or restore construction delayed because of interference with the facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
- B. Temporary facilities are property of the Contractor.
- C. Remove paving that is not acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and fill that does not comply with requirements. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials. Repair or replace street paving, curbs, and sidewalks at the temporary entrances.
- D. At Substantial Completion, renovate permanent facilities used during the construction period, including but not limited to:
  - 1. Replace air filters and clean inside of ductwork and housings.
  - 2. Replace worn parts and parts subject to unusual operating conditions.
  - 3. Replace lamps burned out or noticeably dimmed by substantial hours of use.

**END OF SECTION**



**SECTION 01 58 00**  
**PROJECT IDENTIFICATION**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. The Contractor shall provide and maintain at the site one project sign.
  - 2. No other signs or advertisements will be allowed to be displayed on the premises.

**1.02 QUALITY ASSURANCE**

- A. Design sign and structure to withstand 50 mph wind velocity.
- B. Sign Painter: Engaged as professional sign painter for not less than three years.
- C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

**PRODUCTS**

**2.01 MATERIALS**

- A. Structure and Framing: New wood, 4' x 4' x 8' treated posts, structurally adequate.
- B. Sign Mounting Board: 4' x 8', exterior grade, GPX yellow or green plywood with medium density overlay, minimum 3/4 inch thick.
- C. Rough Hardware: Galvanized, aluminum or brass.
- D. Paint and Primers: Exterior quality, two coats. Color to be White.
- E. Vinyl sign to be provided by Owner and installed by Contractor.

**EXECUTION**

**3.01 CONSTRUCTION**

- A. Install project identification sign within 30 days after date fixed by Owner-Contractor Contract.
- B. Erect at designated location as directed by [Architect] [Owner's Representative].
- C. Erect supports and framing with uprights 36 inches below surface, braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.
- E. Paint sight-exposed surfaces of sign, supports, and framing.

**3.02 MAINTENANCE**

- A. Maintain signs and supports clean. Repair deterioration and damages.

**3.03 REMOVAL**

- A. Remove signs, framing, supports, and foundations at completion of the Project, when directed by [Architect] [Owner's Representative] and restore the area.

**END OF SECTION**

**SECTION 01 60 00**  
**PRODUCT REQUIREMENTS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Products
  - 2. Transportation and Handling
  - 3. Storage and Protection
  - 4. General Product Requirements
- B. Related Sections:
  - 1. Section 01 33 00 (01330) - Submittals and Substitutions
  - 2. Section 01 45 00 (01450) - Quality Control: Product quality monitoring.

**1.02 QUALITY ASSURANCE**

- A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- B. Provide interchangeable components of the same manufacturer, for components being replaced.

**1.03 PRODUCT DELIVERY AND HANDLING**

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
- C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

**1.04 STORAGE AND PROTECTION**

- A. Store and protect Products in accordance with manufacturers' instructions, with seals and labels intact and legible.
- B. Store sensitive Products in weather tight, climate controlled enclosures.
- C. For exterior storage of fabricated Products, place on sloped supports, above ground.
- D. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Product.
- F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

**PRODUCTS**

**2.01 GENERAL PRODUCT REQUIREMENTS:**

- A. Semi-Open Proprietary Specification Requirements: Where Specifications name one or more products or manufacturers, provide one of the products indicated.
  - 1. Where Specifications specify products or manufacturers by name, accompanied by the term "Approved Substitution", the [Architect] [Owner's Representative] will allow products as substitutions only after complying with the requirements of the General Conditions and Section 01 33 00.

- B. The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:

**EXECUTION**

**3.01 NOT USED**

**END OF SECTION**

**SECTION 01 71 23**  
**FIELD ENGINEERING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Quality Assurance
  - 2. Submittals
  - 3. Project Record Documents
  - 4. Survey Requirements
  - 5. Examination
  - 6. Survey Reference Points
- B. Related Sections:
  - 1. General Conditions: Basic site engineering requirements.
  - 2. Section 01 31 32 (00320) - Geotechnical Data: Owner's topographic survey.
  - 3. Section 01 77 00 (01770) - Contract Closeout: Project Record Documents.

**1.02 QUALITY ASSURANCE**

- A. Employ a Land Surveyor or Engineer registered in the State where project is located and acceptable to the Owner [and Architect], to perform survey work of this section.
- B. Submit evidence of Surveyor's or Engineer's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

**1.03 SUBMITTALS**

- A. Submit a copy of registered site drawing and a certificate signed by the Land Surveyor or Engineer, that the elevations and locations of the Work are in conformance with Contract Documents.
- B. On request, submit documentation verifying accuracy of survey work.

**1.04 PROJECT RECORD DOCUMENTS**

- A. Maintain a complete and accurate log of control and survey work as it progresses.
- B. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

**1.05 SURVEY REQUIREMENTS**

- A. Provide field engineering services. Utilize recognized engineering survey practices.
- B. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- C. Submit Project Record Documents under provisions of Section 01 78 39.
- D. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means.
- E. Periodically verify layouts by same means

**PRODUCTS**

**2.01 NOT USED**

**EXECUTION**

**3.01 EXAMINATION**

- A. Verify locations of survey control points prior to starting work. Verify set-backs and easements, confirm drawing dimensions and elevations.
- B. Promptly notify [Architect] [Owner's Representative] of any discrepancies discovered.

**3.02 SURVEY REFERENCE POINTS**

- A. Contractor to locate and protect survey control and reference points.

- B. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- C. Promptly report to [Architect] [Owner's Representative] the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- D. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to [Architect] [Owner's Representative].

**END OF SECTION**

**SECTION 01 73 29**  
**CUTTING AND PATCHING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Administrative and Procedural Requirements for Cutting and Patching
- B. Related Documents:
  - 1. Refer to other Sections of these Specifications, including Divisions 22 (15) through 28 (16), for specific requirements and limitations applicable to cutting and patching individual parts of the work.

**1.02 DEFINITIONS**

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

**1.03 SUBMITTALS**

- A. CUTTING AND PATCHING PROPOSAL:
  - 1. Where approval of procedures is required before proceeding, submit a proposal describing procedures in advance of the time cutting and patching will be performed. Include the following information, as applicable:
    - a. Describe the extent of cutting and patching required and how it is to be performed. Indicate why it cannot be avoided.
    - b. Describe anticipated results, include changes to structural elements and operating components and changes in the building's appearance and other visual elements.
    - c. List products to be used and entities that will perform work.
    - d. Indicate dates when cutting and patching is to be performed.
    - e. List utilities that will be disturbed, including those that will be relocated and those that will be temporarily out-of service. Indicate how long service will be disrupted.
    - f. Approval by the [Architect] [Owner's Representative] to proceed does not waive the [Architect] [Owner's Representative] right to later require complete removal and replacement of work found to be unsatisfactory.

**1.04 STRUCTURAL WORK:**

- A. Do not cut and patch structural elements in a manner that would reduce the load-carrying capacity or load deflection ratio. Obtain approval of the cutting and patching proposal before cutting and patching structural elements.

**1.05 OPERATIONAL AND SAFETY LIMITATIONS:**

- A. Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems.

**1.06 VISUAL REQUIREMENTS:**

- A. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would reduce the building's aesthetic qualities or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

**PRODUCTS**

**2.01 MATERIALS:**

- A. Use materials identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces

to the fullest extent possible. Use materials whose performance will equal or surpass that of existing materials.

## **EXECUTION**

### **3.01 EXAMINATION:**

- A. Before cutting, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding if unsafe or unsatisfactory conditions are encountered.

### **3.02 PREPARATION:**

- A. Provide temporary support of work to be cut.

### **3.03 CLEANING:**

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove paint, mortar, oils, putty and similar items. Thoroughly clean piping, conduit, and similar features before painting or finishing is applied. Restore damaged pipe covering to its original condition.

### **3.04 PROTECTION:**

- A. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.
- B. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- C. Take all precautions to avoid cutting existing pipe, conduit, or ductwork serving the building, but scheduled to be removed, or relocated until provisions have been made to bypass them.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems, when possible, before cutting to minimize interruption to occupied areas.

### **3.05 PERFORMANCE:**

- A. Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- B. Cut existing construction to provide for the installation of other components or the performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

### **3.06 CUTTING:**

- A. All cutting of areas shall be by Contractor requiring cutting, except where noted otherwise in the Specifications and/or Drawings.
- B. Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible, review procedures with the original installer. Comply with the original installer's recommendations.
- C. Where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
- D. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill. Overcuts are NOT allowed
  - 1. At concrete slabs on grade cut existing vapor barrier leaving 6-inches of existing vapor barrier material on each side of cut for splicing in new vapor barrier material.
- E. Comply with requirements of applicable sections of Division 02 where cutting and patching requires excavating and backfilling.

### **3.07 PATCHING:**

- A. All patching shall be provided by Contractor doing cutting work and shall be performed by trade who would customarily be performing that type of work.
- B. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
- C. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  - 1. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch, after the patched area has received primer and second coat.
  - 2. Patch, point or grout flush all voids, holes, chips, cracks, spalls, broken or otherwise damaged surfaces. Patch with materials which match adjacent surfaces in appearance and quality
- D. Repair surfaces exposed by removed finishes, fixtures, or equipment.

**END OF SECTION**



**SECTION 01 74 00**  
**CLEANING AND WASTE MANAGEMENT**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Throughout all phases and items of the construction period, maintain the building and site in a standard of cleanliness as described in this Section including:
    - a. Cleaning Materials and Equipment
    - b. Progress Cleaning
    - c. Final Cleaning
- B. Related Sections:
  - 1. General Conditions.
  - 2. In addition to standards described in this Section, comply with all requirements for cleaning-up as described in various other Sections of these Specifications.

**1.02 QUALITY ASSURANCE**

- A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met
- B. Codes and Standards: In addition to the standards described in this Section, comply with all pertinent requirements of Governmental agencies having jurisdiction.
- C. Disposal of volatile fluid wastes (such as mineral spirits, oil, or paint thinner) in storm or sanitary sewer systems or into streams or waterways is not permitted.

**PRODUCTS**

**2.01 CLEANING MATERIALS AND EQUIPMENT:**

- A. Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

**2.02 COMPATIBILITY:**

- A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Owner's Representative.

**EXECUTION**

**3.01 PROGRESS CLEANING**

- A. General:
  - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding traffic, and providing the required protection of materials.
  - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for the construction of this work.
  - 3. Twice weekly, and more often if necessary, the Contractor shall completely remove all scrap, debris, and waste material from the job site, and shall place into container furnished by the Contractor.
  - 4. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection.
- B. Project Site; The Contractor shall:
  - 1. Daily, and more often if necessary, inspect the project site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
  - 2. Weekly, and more often if necessary, sweep all interior places clean. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by reasonable diligence using a hand-held broom.
  - 3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer

of the succeeding material, using all equipment and materials required to achieve the required cleanliness.

4. Following the installation of finish floor materials, protect by covering with temporary coverings and/or clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials have been installed. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from all foreign material, which may be injurious to the finish floor material.

### **3.02 FINAL CLEANING**

- A. Definition: Except as otherwise specifically provided, "Clean" (for the purpose of this Article) shall be interpreted as meaning the level of cleanliness generally provided by commercial building maintenance Subcontractors using commercial quality building maintenance equipment and materials.
- B. General: Prior to completion of the work, remove from the job site all tools, temporary structures, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.01 above.
- C. Interior: Visually inspect all interior surfaces and remove all traces of soil, waste material, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only the specified cleaning materials and equipment.
- D. Repair, patch, and touch-up marred or damaged surfaces to match adjacent finishes.
- E. Clean the following if located within the project area:
  1. Plumbing Fixtures, Strainers and Floor Drains
  2. Light Fixtures and Lamps
  3. Replace filters of ventilating equipment when units have been operating during construction. In addition, clean grilles and louvers.
  4. Excess lubrication is to be removed from mechanical and electrical equipment.
  5. All Electrical Panels
- F. Clean all transparent materials, including glass and mirrors. Remove glazing compound and other substances that are noticeable from vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
- G. Remove labels that are not permanent labels.
- H. Polished and Resilient Surfaces: To all surfaces requiring the routine application of protective waxes and/or buffed polish, apply the specified coating and/or polish as recommended by the manufacturer of the material being treated, as specified in individual Specification Sections.
- I. Leave concrete floors broom clean. Vacuum carpeted surfaces.
- J. Clean areas traversed by construction personnel.
- K. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean. Remove stains, spills, and other foreign deposits.
- L. Maintain cleaning until the building, or portion thereof, is accepted by the Owner.
- M. Timing: Schedule final cleaning as approved by the [Architect] [Owner's Representative] to enable the Owner to accept a completely clean project.

### **END OF SECTION**

**SECTION 01 77 00**  
**CLOSEOUT PROCEDURES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Closeout Procedures
  - 2. Inspection Procedures
- B. Related Sections:
  - 1. Section 01 33 00 (01330) - Submittal and Substitution Procedures
  - 2. Section 01 74 00 (01740) - Cleaning and Waste Management
  - 3. Section 01 78 13 (01780) - Bonds and Warranties
  - 4. Section 01 78 39 (01785) - Project Record Documents
  - 5. Section 01 78 43 (01790) - Spare Parts and Materials
  - 6. Section 01 79 00 (01820) - Training
  - 7. Section 01 78 23 (01830) - Operating and Maintenance Data

**1.02 REFERENCES**

**1.03 DEFINITIONS**

- A. Closeout is hereby defined to include general requirements near end of Contract Time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner, and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in sections of Divisions 2 (02) through 16 (33). Time of closeout is directly related to "Substantial Completion", and shall be a single time period for the entire work.

**1.04 PREREQUISITES TO SUBSTANTIAL COMPLETION**

- A. General: Prior to requesting inspection for Substantial Completion (for either entire work or portions thereof), complete the following and list known exceptions in request:
  - 1. Include supporting documentation for completion as indicated in these Contract Documents.
  - 2. Submit statement showing accounting of changes to Contract Sum.
  - 3. The Contractor shall prepare, submit and complete a punch list in accordance with General Conditions.
  - 4. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications, and similar documents.
  - 5. Obtain and submit releases enabling Owner's full and unrestricted use of the work and access to services and utilities, including (where required) occupancy permits, operating certificates, waivers of lien, and similar releases.
  - 6. Submit record drawings, maintenance manuals, and similar final record information.
  - 7. Deliver tools, spare parts, extra stocks of materials, and similar physical items to Owner.
  - 8. Complete start-up testing of systems, and instructions of Owner's operating/maintenance personnel. Discontinue (or change over) and remove from project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar elements.
  - 9. Complete final cleaning up requirements, including touch-up painting of marred surfaces.
  - 10. Touch-up and otherwise repair and restore marred, exposed finishes.

**1.05 INSPECTION PROCEDURES:**

- A. Upon receipt of Contractor's request, the Architect will either proceed with inspection or advise Contractor of prerequisites not fulfilled. Following initial inspection, the [Architect] [Owner's Representative] will establish the date of Substantial Completion, or advise Contractor of work which must be performed prior to establishing date; and repeat inspection when requested and assured that work has been substantially completed. Results of completed inspection will form initial "punch-list" for final acceptance.

## **1.06 RECORD DOCUMENTS**

- A. General: Specific requirements for record documents are indicated in individual sections of these Specifications. Other requirements are indicated in General Conditions. General submittal requirements are indicated in "Submittals" sections. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for [Owner's Representative] [and] [or] [Architect's] reference during normal working hours.

## **PRODUCTS**

### **2.01 NOT USED**

## **EXECUTION**

### **3.01 CLEANING**

- A. General: Special cleaning for specific units of work is specified in sections of Divisions 02 through 33. General cleaning during progress of work is specified in General Conditions and as temporary services in Section 01 74 00. Provide final cleaning of the work, at time indicated, consisting of cleaning each surface or unit of work to normal "clean" condition expected for a first-class building cleaning and maintenance program. Comply with manufacturer's instructions for cleaning operations.
  - 1. Where extra materials of value remain after completion of associated work have become Owner's property, dispose of these to Owner's best advantage as directed.

**END OF SECTION**

**SECTION 01 78 23**  
**OPERATION AND MAINTENANCE DATA**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. This Section specifies the administrative requirements, procedural obligations, terms and conditions and general requirements related to the preparation and submittal of instruction manuals covering the materials installed, care, preservation and maintenance of products, finishes, equipment and systems.
- B. Related Sections:
  - 1. Special operating and maintenance data requirements for specific equipment or building operating systems are included in the appropriate Specifications Sections of Divisions 02 through 33.
  - 2. Preparation of Shop Drawings and Product Data are included in Specification Section 01 33 00, "Submittals and Substitutions".
  - 3. General closeout requirements are included in Specification Section 01 77 00, "Contract Closeout".
  - 4. General requirements for submittal of Project Record Documents are included in Section 01 78 39, "Project Record Documents".

**1.02 SUBMITTALS**

- A. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals:
  - 1. Submit [two (2)] copies of the first and subsequent drafts of each manual for review. Include a complete index and table of contents for each volume. One (1) copy will be returned within 45 days of receipt with comments. The first draft shall be at least 95% complete. Provide FINAL manuals prior to commencement of training; these manuals shall be utilized as instructional text during the building orientation and training processes. Refer to Section 01 78 39.
- B. Form of Submittal: Manuals should be prepared in the form of an instructional manual for use by the Owner's operating personnel and/or property management company. The information should be bound as follows:
  - 1. Binders: For each manual, provide heavy-gauge, commercial quality, vinyl hanging VUE presentation binders in 3" capacity sized to receive 8-1/2" by 11" paper. Binder color shall be white.
    - a. Identify each binder on the spine with the typed or printed title "OPERATION AND MAINTENANCE MANUAL", project name and subject matter covered.
    - b. Indicate the volume number for multiple volume sets of manuals.
  - 2. Dividers: Manual contents shall be organized and divided by specification divisions using index maker dividers.
  - 3. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
  - 4. Text Material: Where written material is required as part of the manual, use the manufacturer's standard printed material.
  - 5. Drawings: Where drawings or diagrams are required as part of the manual, provide protective plastic jackets for the drawings and bind in with the text.

**1.03 GENERAL MANUAL CONTENT**

- A. In each manual, include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:
  - 1. General system or equipment description.
  - 2. Design factors and assumptions.
  - 3. Copies of approved shop drawings, product data, installation instructions and setup/calibration procedures.

4. Load and performance testing reports including equipment and system startup/performance documentation.
  5. Fire/flame spread test certificates.
  6. System or equipment identification, including:
    - a. Name of manufacturer
    - b. Model number
    - c. Serial number
  7. Standard operating instructions.
  8. Emergency operating instructions.
  9. Wiring diagrams including color coding, labeling and terminal designations.
  10. Inspection and test procedures.
  11. Detailed preventative maintenance procedures, frequencies and special tool requirements.
  12. Operator trouble-shooting guide.
  13. Precautions against improper use and maintenance.
  14. Copies of warranties, including extended warranty options.
  15. General owners operating/service manual.
  16. Factory service manuals, including repair instructions and illustrated parts listing.
  17. Electronic copies of operating system software (3.5 in. diskettes or CD-ROM).
  18. Material safety data sheets.
  19. Sources of required maintenance materials repair/replacement parts and related services.
  20. Copies of inspections and certifications by governing authorities.
- B. Manual Index: Organize each manual into separate Sections for each piece of related equipment. As a minimum each manual shall contain a title page, a table of contents, copies of Product Data, supplemented by drawings and written text, and copies of each warranty, bond and service contract proposal.
- C. Title Page: Provide a title page as the first sheet of each manual. Provide the following information.
1. Subject matter covered by the manual.
  2. Name and number of the Contract.
  3. Date of submittal.
  4. Name, address, and telephone number of the Contractor and Subcontractor.
  5. Name and address of the Architect/Engineer.
  6. Cross reference to related systems in other operating and maintenance manuals.
- D. General Table of Contents: After the Title Page, include a typewritten table of contents for each volume (Divisions 02 through 33 inclusive), arranged according to the specification format.
- E. General Information: Provide a general information Section immediately following the Table of Contents, listing by Specification Section each major product included in the manual, identified by product name. Under each product, list the name, address, telephone number, and point of contact of the Subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.
- F. Product Data: Where manufacturer's standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one item in a tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information that is not applicable.
1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:
    - a. Manufacturer's Catalog Number
    - b. Size
    - c. Material Composition
    - d. Color

- e. Texture
- f. Re-ordering Information for Specially Manufactured Products
- 2. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.
- 3. Color Schedules: Provide information showing manufacturer's color name and catalog number for all exposed finishes, including paint, carpet, wallcoverings, and other finish materials.
- 4. Moisture-Protection and Weather-Exposed Products: Provide complete manufacturer's data with instructions on inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes.
  - a. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:
    - 1) Applicable standards
    - 2) Chemical composition
    - 3) Installation details
    - 4) Inspection procedures
    - 5) Maintenance information
    - 6) Repair procedures
- G. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.
  - 1. Description: Provide a complete description of each unit and related component parts, including the following:
    - a. Equipment or system function
    - b. Operating characteristics
    - c. Limiting conditions
    - d. Performance curves
    - e. Engineering data and tests
    - f. Complete nomenclatures and number of replacement parts
  - 2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following:
    - a. Printed operating and maintenance instructions.
    - b. Assembly drawings and diagrams required for maintenance.
    - c. Recommended parts inventory listing.
  - 3. Provide information detailing essential maintenance procedures, including the following:
    - a. Routine operations
    - b. Trouble-shooting guide
    - c. Disassembly, repair and reassembly
    - d. Alignment, adjusting and checking
  - 4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
    - a. Start-up procedures
    - b. Equipment or system break-in
    - c. Routine and normal operating instructions
    - d. Regulation and control procedures
    - e. Instructions on stopping
    - f. Shut-down and emergency instructions
    - g. Day and night operating instructions
    - h. Summer and winter operating instructions
    - i. Required sequences for pneumatic, electric, electronic or direct digital control systems
    - j. Special operating instructions

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
6. Controls: Provide a comprehensive description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
7. Drawings: Provide copies of each Contractor/Subcontractor set of coordination drawings.
8. Valve Tags: Provide charts of valve tag numbers with the room number location and function of each valve. Valve tag locations shall be clearly indicated on the set of record "As-Built" drawings.
9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:
  - a. Electric power
  - b. Lighting
  - c. Communications
  - d. Fire Alarm
- H. Written Test: Where manufacturer's standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written text to provide necessary information. Organize the text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure.
- I. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation. Do not use original Project Record Documents as part of the Operating and Maintenance Manuals.
- J. Warranties, Bonds, and Service Contracts: Provide a photocopy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure including the return policies/procedures. List circumstances and conditions that would affect validity of the warranty or bond. Commencement and expiration dates shall be clearly indicated.
- K. Provide complete information in the manual on products specified in Divisions 02 through 33.

#### **1.04 TRAINING OF OPERATING AND MAINTENANCE PERSONNEL**

- A. Prior to final inspection, instruct the hotel personnel in operation, adjustment, and maintenance of products, equipment and systems.
  1. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.
  2. Refer to Specification Section 01 79 00, "Training", for detailed training requirements

#### **1.05 OPERATING MAINTENANCE MANUALS**

- A. Submit copies of each manual, in the form specified, to the [Architect] [Owner's Representative] for distribution.
  1. Refer to individual Specification Sections and other paragraphs within this Section for additional requirements.
- B. Manuals should be organized into separate and distinct volumes (binders) as described hereafter:
  1. "SITE WORK"
    - a. Asphalt Concrete Pavement
    - b. Tack and Prime Coat
    - c. Concrete Curbs and Sidewalks
    - d. Pavement Markings
    - e. Guide Rail



- f. Termite Control
  - g. Traffic Signage
- 2. "SITE WORK UTILITIES"
  - a. Water and Sanitary Sewer Facilities
  - b. Drainage Structures
  - c. Underdrains
  - d. Electrical Power Service
  - e. Gas Utility
- 3. "Landscape and Site Improvements"
  - a. Soil Preparation and Seeding
  - b. Trees, Plants, and Ground Cover
  - c. Fences and Gates
  - d. Playfields and Equipment
  - e. Site and Street Furnishings
- 4. "BUILDINGS AND STRUCTURES"
  - a. Concrete
  - b. Unit Masonry
  - c. Metals
  - d. Woods and Plastics
  - e. Thermal and Moisture Protection
  - f. Doors and Windows
  - g. Finishes
  - h. Specialties
  - i. Fixtures, Furnishings, and Equipment
- 5. "WAYFINDING"
  - a. Exterior Signage
  - b. Exterior Post/Panel and Overhead Panel Signs
- 6. "SWIMMING POOLS AND SPAS"
  - a. Basic Piping and Pumps
  - b. Filtering and Deck Equipment
  - c. Pool Heater and Controls
  - d. Chemical Treatment
- 7. "HYDRAULIC ELEVATORS"
- 8. "MECHANICAL, HVAC"
  - a. Basic Materials and Methods
  - b. Piping and Specialties
  - c. Insulation
  - d. Pumping
  - e. Refrigeration
  - f. Air Handling and Distribution
  - g. Automatic Temperature Control
  - h. Testing/Adjusting/Balancing
- 9. "MECHANICAL, PLUMBING"
  - a. Basic Materials and Methods
  - b. Piping and Specialties
  - c. Insulation
  - d. Fixtures/Trim/Accessories
  - e. Water Heaters
  - f. In-Line Circulating Pumps
  - g. Water Softening Equipment
- 10. "FIRE SPRINKLERS"
  - a. Basic Materials and Methods
  - b. Standpipe and Hose Systems
  - c. Fire Pumps

- d. Dry Pipe Sprinkler Systems
- e. Wet Pipe Sprinkler Systems
- 11. "ELECTRICAL"
  - a. Basic Materials and Methods
  - b. Service and Distribution
    - 1) Service Entrance
    - 2) Switchboards
    - 3) Disconnects
    - 4) Grounding
    - 5) Transformers
    - 6) Panelboards
    - 7) Overcurrent Protective Devices
    - 8) Contactors
    - 9) Voltage Surge Suppression
    - 10) Heat Tracing
  - c. Lighting
    - 1) Interior and Exterior Luminaries, Lamps and Accessories
    - 2) Emergency Lighting
    - 3) Lighting Control Equipment
- 12. "SOUND SYSTEMS"
- 13. "COMMUNICATIONS"
  - a. Voice and Data
  - b. Television Distribution System
  - c. Security Intercom System
- 14. "FIRE ALARM SYSTEM"

**1.06 MAINTENANCE OF DOCUMENTS AND SAMPLES: STORE RECORD DOCUMENTS AND SAMPLES IN THE FIELD OFFICE APART FROM CONTRACT DOCUMENTS USED FOR CONSTRUCTION. DO NOT PERMIT PROJECT RECORD DOCUMENTS TO BE USED FOR CONSTRUCTION PURPOSES. MAINTAIN RECORD DOCUMENTS IN GOOD ORDER AND IN A CLEAN, DRY, LEGIBLE CONDITION. MAKE DOCUMENTS AND SAMPLES AVAILABLE AT ALL TIMES FOR INSPECTION BY THE OWNER'S REPRESENTATIVE OR ARCHITECT.**

## **PRODUCTS**

**2.01 NOT USED**

## **EXECUTION**

**3.01 NOT USED**

**END OF SECTION**

**SECTION 01 78 39**  
**PROJECT RECORD DOCUMENTS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. This Section specifies administrative and procedural requirements for Project Record Documents to be prepared and submitted by the General Contractor.
  - 2. Project Record Documents required include:
    - a. Marked-Up Copies of Record Drawings, Specifications, and Product Data
    - b. Record Samples
    - c. Miscellaneous Record Submittals
- B. Related Sections:
  - 1. General project closeout requirements are included in "Contract Closeout", Section 01 77 00.
  - 2. General requirements for submittal of Shop Drawings and Product Data are included in General Conditions and the Section "Submittals and Substitutions," Section 01 33 00.
  - 3. Specific record copy requirements that expand requirements of this Section are included in the individual Sections of Divisions 02 through 33.
  - 4. Operating and maintenance data is specified in Section 01 78 23.

**1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES**

- A. Refer to General Conditions, Article 17.

**1.03 RECORD DRAWINGS**

- A. The Contractor shall maintain a white-print set (blue-line or black-line) of Contract Drawings and Shop Drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where Shop Drawings are used for mark-up, record a cross reference at corresponding location on working drawings. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either Contract Drawings or Shop Drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each set.
- B. Responsibility for Markup: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installer, Subcontractor, or similar entity, is required to prepare the mark-up on Record Drawings.
- C. At time of Substantial Completion, submit Record Drawings to Owner for Owner's records in accordance with General Conditions, Article 17.
  - 1. Refer to Section 01 78 23 for items to be included in manuals.
  - 2. Three (3) copies will be required.

**1.04 RECORD SPECIFICATIONS**

- A. The Contractor shall maintain one copy of specifications, including addenda, change orders, and similar modifications issued in printed form during construction, and mark-up variations (of substance) in actual work in comparison with text of specifications and modifications as issued. Give particular attention to substitutions, selection of option, and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable. Upon completion of mark-up, submit to [Architect] [Owner's Representative].

1. The Contractor is responsible for collecting marked-up record Sections from each of the other Subcontractors, and for collating these Sections in proper numeric order with its own Sections to form a complete set of record Specifications. Submit to the Owner.
  - a. Three (3) copies will be required.

#### **1.05 PRODUCT DATA**

- A. During the construction period, maintain one copy of each Product Data submittal for Project Record Document purposes.
  1. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation.
  2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  3. Note related Change Orders and mark-up of Record Drawings, where applicable.
  4. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data. Refer to Section 01 78 23 (01830) for requirements. Submit to the Owner.
  5. The Contractor is responsible for mark-up and submittal of record Product Data.

#### **1.06 SAMPLES**

- A. Immediately prior to date of Substantial Completion, the Contractor shall meet with the Owner at the site to determine which of the Samples maintained during the construction period shall be transmitted to the Owner for record purposes. Comply with the Owner's instructions for packaging, identification marking, and delivery to Owner's storage space. Dispose of other Samples in manner specified for disposal of surplus and waste materials.

#### **1.07 MISCELLANEOUS RECORD SUBMITTALS**

- A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Owner.
  1. Categories of requirements resulting in miscellaneous records include, but are not limited to, the following:
    - a. Field Records on Excavations and Foundations
    - b. Field Records on Underground Construction and Similar Work
    - c. Survey Showing Locations and Elevations of Underground Lines
    - d. Invert Elevations of Drainage Piping
    - e. Surveys Establishing Building Lines and Levels
    - f. Authorized Measurements Utilizing Unit Prices or Allowances
    - g. Batch Mixing and Bulk Delivery Records
    - h. Load and Performance Testing
    - i. Inspections and Certifications by Governing Authorities
    - j. Leakage and Water-Penetration Tests
    - k. Fire Resistance and Flame Spread Test Results
    - l. Final Inspection and Correction Procedures

### **PRODUCTS**

#### **2.01 NOT USED**

### **EXECUTION**

#### **3.01 RECORDING**

- A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

### **END OF SECTION**

**SECTION 01 78 43**  
**SPARE PARTS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Spare Parts and Materials
- B. Related Sections:
  - 1. Refer to individual sections for items listed herein, as well as other requirements.

**PRODUCTS**

**2.01 EXTRA MATERIALS - GENERAL**

- A. At the time of building acceptance, deliver to the Owner the following extra materials. Deliver in original unopened cartons or containers (except paint) with each item properly identified.

**2.02 ASPHALT SHINGLES (07 31 13)**

- A. Furnish minimum of one full square of each type/color/texture shingle used in the work. Provide in unopened, clearly labeled bundles or containers.

**2.03 JOINT SEALANTS (07 92 00)**

- A. Furnish extra sealant materials from same production run as the materials applied in the quantities described below. Package materials in unopened, factory-sealed containers with labels describing contents.
  - 1. Quantity: Furnish one unused tube of each type and color of exterior sealant applied.

**2.04 TILING (09 30 00)**

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to one case for each type, composition, color, pattern, and size indicated.

**2.05 ACOUSTIC TILE CEILINGS (09 51 23)**

- A. Replacement stock amounting to one full box (minimum 12 tiles) of each type.

**2.06 PLASTIC-LAMINATE FLOORING (09 62 19)**

- A. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
  - 1. Flooring: Equal to one full box of amount installed for each pattern and color indicated.
  - 2. Trim: 10 lineal feet of each profile used.

**2.07 WOOD PARQUET FLOORING (09 64 23)**

- A. Furnish extra materials matching products installed, packaged with protective covering for storage and identified with labels clearly describing contents.
  - 1. Flooring: Equal to one full carton of product installed from same production run as original material supplied to the project.
  - 2. Include manufacturer's instruction sheet, including sources and contact information to obtain recommended adhesives and technical assistance.

**2.08 RESILIENT FLOORING (09 65 00)**

- A. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
  - 1. Furnish not less than one box of each class, wearing surface, color, pattern, and size of resilient floor tile installed.

## **2.09 CARPETING (09 68 00)**

- A. Furnish extra materials described below before installation begins that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. The Owner shall be permitted to view all carpet scraps and retain any that is chosen for future repairs before they are removed from the job site.

## **2.10 PAINTING AND SPECIAL COATINGS (09 90 00 / 09 96 00)**

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage.
  - 1. Quantity: Furnish the Owner with two gallons of each material and color applied in addition to any leftover amounts.
  - 2. All cans shall be labeled with Finish Index number.

## **2.11 WALLCOVERING (09 72 00)**

- A. Package materials with protective covering and identify with labels describing contents.
  - 1. Furnish full-size units equal to two full rolls of each type installed and return all unused material to Owner.

## **2.12 FIRE SUPPRESSION (21 10 00)**

- A. Operating key handles: Furnish one extra for each key-operated hose bibb and hydrant installed.
- B. Sprinkler Cabinets:
  - 1. Finished, wall-mounting steel cabinet and hinged cover, with space for a minimum of six spare sprinklers plus sprinkler wrench.
  - 2. Include the number of sprinklers required by NFPA 13 and wrench for sprinklers.
  - 3. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

## **2.13 PLUMBING FIXTURES (22 40 00)**

- A. Shower Heads: Two units of each type.
- B. Faucet Sets: Five complete sets for Guest Room units.
- C. Toilet Seats: Furnish quantity of identical units not less than 2 of each type installed.

## **2.14 PLUMBING SPECIALTIES (22 40 00.01)**

- A. Operating key handles: Furnish one extra for each key-operated hose bibb and hydrant installed.

## **2.15 DUCT ACCESSORIES (23 33 00)**

- A. Fusible Links: Furnish quantity equal to 5 of each type installed.

## **2.16 POWER VENTILATORS (23 34 23)**

- A. Furnish one set of belts for each belt-driven fan that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

## **2.17 ELF-CONTAINED AIR-CONDITIONING UNITS (23 81 19)**

- A. Filters: One set of filters for each unit for PTAC, VTAC, split A/C and Packaged HVAC units.
- B. Fan Belts: One set of belts for each unit for Packaged HVAC units.

## **2.18 PACKAGED TERMINAL AIR CONDITIONING UNITS (23 81 13.13)**

- A. Replacement stock amounting to providing four complete spare units the most common size used.
- B. Furnish two spare thermostat for each type/size installed.

## **2.19 ENCLOSED CONTROLLERS (26 29 13)**

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents:
  - 1. Spare Fuses and Incandescent Indicating Lamps: Furnish one set of three for each kind.

## **2.20 INTERIOR LIGHTING (26 51 00)**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
  - 1. Lamps: Five of each rating installed of the following types (Refer the Light Fixture Schedule located in the Appendix):
    - a. Incandescent
    - b. Fluorescent
    - c. Compact Fluorescent
    - d. Metal Halide

## **2.21 EXTERIOR LIGHTING (26 56 00)**

- A. Furnish extra materials described below that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: Five of each rating installed of the following types (Refer the Light Fixture Schedule located in the Appendix):
    - a. Incandescent.
    - b. Fluorescent
    - c. Compact Fluorescent
    - d. Metal Halide

## **2.22 FIRE ALARM AND DETECTION SYSTEMS (28 31 00)**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
  - 1. Lamps for remote indicating lamp units: Two units.
  - 2. Lamps for strobe units: Two units.
  - 3. Smoke detectors, fire detectors, and carbon monoxide detectors: Two units of each type.
  - 4. Detector bases: Two units of each type.

## **2.23 [CONCRETE] [BRICK] PAVER UNITS ([32 14 13]) [32 14 16])**

- A. Furnish stock of pavers that match blend of products installed in the amount of 10 sf.

## **EXECUTION**

### **3.01 NOT USED**

**END OF SECTION**

**SECTION 01 79 00**  
**DEMONSTRATION AND TRAINING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. This Section specifies the administrative requirements, procedural obligations, terms and conditions and training requirements related to instructing the facility engineering personnel in the proper care, preservation, operations and maintenance of materials, finishes, equipment and systems.
    - a. Preparation and submittal of instructor qualifications, training schedules, and agendas for various building materials, components, systems and equipment.
    - b. Instruction of the Owner's personnel and adjunct organizations in the proper operation and maintenance of all building materials, components, systems and equipment.
- B. Related Sections:
  - 1. Special operating and maintenance data requirements for specific equipment or building operating systems are included in the appropriate Specification Sections of Divisions 02 through 33.
  - 2. Preparation of Shop Drawings and Product Data are included in Specification Section 01 33 00 (01330), Submittals and Substitutions.
  - 3. General closeout requirements are included in Specification Section 01 77 00 (01770). Contract Closeout.
  - 4. General requirements for submittal of Project Record Documents are included in Section 01 78 39 (01785), Project Record Documents.
  - 5. Additional training requirements for building systems and/or equipment are delineated in the appropriate Specification Sections, Divisions 02 through 33.
  - 6. Where training manuals include information on work installed by the Contractor and their Subcontractors, the Contractor shall be responsible for the preparation of the manuals, including collection, collation and binding of the material and submittal of data as specified.

**1.02 QUALITY ASSURANCE**

- A. The status of training deliverables shall be an integral part of the Contractor's coordination process. The Contractor shall meet with the Owner as required, to discuss progress-to-date, deficiencies and non-compliance issues.

**1.03 TRAINING MANUALS**

- A. The completed FINAL VERSION of the approved Operation & Maintenance Manuals and the redlined set of the record "as-built" drawings shall be used as the basis of instruction. The Contractor is not responsible for providing additional copies of these documents for training purposes.

**1.04 TRAINING HOURS**

- A. Training shall be conducted during normal working hours. All training shall be completed prior to the public opening of the hotel property.

**PRODUCTS**

**2.01 NOT USED**

**2.02 EXECUTION**

**2.03 TRAINING OF FACILITY ENGINEERING, OPERATING AND MAINTENANCE PERSONNEL**

- A. Instruct the hotel's personnel in operation, adjustment, and maintenance of all materials, components, equipment and systems.
  - 1. Use the Operation and Maintenance Manuals and the Record "As-Built" Drawings for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of installation, care and preservation, operation, preventive maintenance, service, and replacement.



2. The detailed review of the materials, components, systems and equipment shall include as minimum the following items:
    - a. Materials, components, systems and equipment
    - b. Safety precautions and procedures
    - c. Installation
    - d. Operational features and functions
    - e. Operational testing and diagnostics
    - f. Preventive and predictive maintenance
    - g. Service: Repair and replacement
    - h. Operation and Maintenance manual content
    - i. Commissioning: Testing, adjusting, calibration and balancing
    - j. Contractor furnished spare parts and extra materials
    - k. Recommended "spare parts" inventory not furnished by Contractor
    - l. Specialty tool requirements
    - m. Lubricants
    - n. Fuels
    - o. Identification systems
    - p. Automatic/manual control systems
    - q. Hazards/Material Safety Data Sheets
    - r. Cleaning
    - s. Procurement of replacement parts
    - t. Warranty reviews including terms and conditions, points of contact, return material procedures, effective date, extended warranty options
    - u. Maintenance agreements and similar continuing commitments
    - v. Record "As-Built" Drawings
  3. As part of the operations portion of the training session, demonstrate all operational features and functions.
  4. Refer to other specification Sections for additional training requirements associated with engineering, operating and maintenance of various systems/equipment.
- B. Provide a combination of classroom, field and factory training classes which includes as a minimum the following curricula requirements as indicated hereafter:
1. SITE WORK UTILITIES: one 2-hour class
    - a. Water, Storm, and Sanitary Sewer Facilities
    - b. Drainage Structures
    - c. Underdrains
    - d. Electrical Power Service
    - e. Gas Utilities
  2. BUILDINGS AND STRUCTURES: one 4-hour class
    - a. Concrete
    - b. Unit Masonry
    - c. Metals
    - d. Woods and Plastics
    - e. Thermal and Moisture Protection
    - f. Doors and Windows
    - g. Finishes
    - h. Specialties
    - i. Fixtures, Furnishings and Equipment
  3. ELEVATORS: one 1-hour class
  4. HVAC: one 8-hour class
    - a. Basic Materials and Methods
    - b. Piping and Specialties
    - c. Insulation
    - d. Pumping
    - e. Refrigeration

- f. Air Handling and Distribution
- g. Pool Dehumidification
- h. Automatic Temperature Controls
- i. Testing/Adjusting/Balancing
- 5. PLUMBING: one 4-hour class
  - a. Basic Materials and Methods
  - b. Piping and Specialties
  - c. Insulation
  - d. Pumping
  - e. Fixtures, Trim and Accessories
  - f. Domestic Water Heaters
  - g. Water Softening
- 6. SWIMMING POOLS AND SPAS: one 2-hour class
  - a. Basis Piping and Pumps
  - b. Filter and Deck Equipment
  - c. Pool Heater
  - d. Water Treatment
- 7. FIRE SPRINKLERS: one 2-hour class
  - a. Basic Materials and Methods
  - b. Standpipe and Hose Systems
  - c. Wet Pipe Sprinkler Systems
- 8. ELECTRICAL: one 8-hour class
  - a. Basic Materials and Methods
  - b. Service and Distribution
  - c. Service Entrance
  - d. Switchboards
  - e. Disconnects
  - f. Grounding
  - g. Transformers
  - h. Panelboards
  - i. Overcurrent Protective Devices
  - j. Contactors
  - k. Voltage Surge Suppression
  - l. Testing
  - m. Lighting
  - n. Interior and Exterior Luminaries, Lamps and Accessories
  - o. Emergency Lighting
  - p. Heat Tracing
- 9. SOUND SYSTEM: one 1-hour class
- 10. COMMUNICATION: one 2-hour class
  - a. Voice and Data
  - b. Television Distribution System
  - c. Security Intercom System
- 11. FIRE ALARM SYSTEM: one 4-hour class
  - a. System Zoning and Operations
  - b. End-Devices
  - c. Carbon Monoxide Monitoring
  - d. Supervisory and Control Interface

## **2.04 SPRINKLER SYSTEMS**

## **2.05 ELEVATORS**

## **2.06 HVAC FAN CONTROL**

## **2.07 TELEPHONE**

A. Graphic Enunciators

B. Signage

1. FOOD SERVICE & LAUNDRY EQUIPMENT: one 8-hour class

a. The Food Service & Laundry Equipment Contractor shall schedule demonstrations of all Class 2, 3 and 4 equipment by Factory Authorized Demonstrators, at times convenient to the Owner. Demonstration shall include competent instruction in the use, cleaning, repair, and maintenance of the equipment.

- 1) Class 1 - Equipment that requires no demonstration. Written instructions will suffice (i.e. roll warmers, toasters, racks, refrigerators, etc.).
- 2) Class 2 - Equipment that is easy to understand and quickly demonstrated by a Factory Authorized Demonstrator (i.e. ranges, slicers, disposers, etc.).
- 3) Class 3 - Complex equipment which requires more in-depth knowledge of assembly, operation, maintenance or cleaning. (i.e. steam equipment, multi-tank dish washers, fryer batteries, etc.).
- 4) Class 4 - High technology equipment or systems that require extensive training, or for which demonstrations are factory-required. (i.e. cook-chill systems, conveyor ovens, etc.).

**END OF SECTION**

**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**GENERAL**

**1.01 SUMMARY**

- A. Section includes:
  - 1. Cast-in place concrete, including formwork, reinforcement, concrete materials, accessories mix design, placement procedures, and finishes.
- B. Related Sections:
  - 1. Section 03 54 13 (03500) - Cementitious Decks and Underlayment
  - 2. Section 05 50 00 (05500) - Metal Fabrications
  - 3. Section 07 10 00 (07100) - Dampproofing and Waterproofing
  - 4. Section 07 92 00 (07920) - Joint Sealants
  - 5. Section 13 11 00.02 (13152) - Swimming Pools - Indoor
  - 6. Section 32 13 13 (02751) - Cement Concrete Paving
  - 7. Section 33 00 00 (02500) - Utility Services

**1.02 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project.
- C. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- D. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures. Coordinate built-in items including anchor bolts, plates and clips.
- E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.
  - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- F. Welding Certificates: Copies of certificates for welding procedures and personnel.
- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- H. Material Certificates: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01300) indicating specified items selected for use in project.
  - 1. Cementitious materials and aggregates.
  - 2. Form materials and form-release agents.
  - 3. Steel reinforcement and reinforcement accessories.
  - 4. Fiber reinforcement.
  - 5. Admixtures.

6. Waterstops.
7. Curing materials.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Epoxy joint filler.
13. Joint-filler strips.
14. Repair materials.

I. Minutes of preinstallation conference.

#### **1.04 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer with a minimum of five years experience, who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.
- C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
  1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's (NRMCA) "Certification of Ready Mixed Concrete Production Facilities."
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated, as documented according to ASTM E548.
  1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
  1. ACI 301, "Specification for Structural Concrete."
  2. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
  3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete".
  4. ACI 211.2 "Standard Practice for Selecting Proportions for Structural Lightweight Concrete".
  5. ACI 212 "Chemical Admixtures for Concrete"
  6. ACI 214R "Evaluation of Strength Test Results of Concrete"
  7. ACI 301 "Standard Specification for Structural Concrete"
  8. ACI 302 "Guide for Concrete Floor and Slab Construction"
  9. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete".
  10. ACI 305R "Hot Weather Concreting".
  11. ACI 306R "Cold Weather Concreting".
  12. ACI 308 "Standard Practice for Curing Concrete"
  13. ACI 309R "Guide for Consolidation of Concrete".
  14. ACI 311.4R "Guide for Concrete Inspection".

15. ACI 318 "Building Code Requirements for Structural Concrete".
  16. ACI 347R "Guide to Formwork for Concrete".
  17. ACI 544 "Fibers Reinforced Concrete"
  18. ACI SP-66 "ACI Detailing Manual".
- H. Other Publications. Comply with the following, unless more stringent provisions are indicated:
1. CRSI-WCRSI "Placing Reinforcing Bars"
  2. AWS D1.4 "Structural Welding Code - Reinforcing Steel".
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Sections.
1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixes.
    - c. Ready-mix concrete producer.
    - d. Concrete subcontractor.

## **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
1. Avoid damaging coatings on steel reinforcement.
  2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D3963.

## **PRODUCTS**

### **2.01 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
  2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1, or better.
    - b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
    - c. Structural 1, B-B, or better, mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706, deformed.
- C. Epoxy-Coated Reinforcing Bars: ASTM A775, and as follows:
- D. Epoxy-Coated Fabricated Reinforcing Bars: ASTM A934, and as follows:
  1. Steel Reinforcement: ASTM A615, Grade 60, deformed.
  2. Steel Reinforcement: ASTM A706, deformed.
- E. Steel Bar Mats: ASTM A184, assembled with clips.
  1. Steel Reinforcement: ASTM A615, Grade 60, deformed bars.
  2. Steel Reinforcement: ASTM A706, deformed bars.
- F. Plain-Steel Wire: ASTM A82, as drawn.
- G. Plain-Steel Wire: ASTM A82, galvanized.
- H. Deformed-Steel Wire: ASTM A496.
- I. Epoxy-Coated Wire: ASTM A884, Class A coated, plain-steel wire.
- J. Epoxy-Coated Wire: ASTM A884, Class A coated, deformed-steel wire.
- K. Plain-Steel Welded Wire Fabric: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
- L. Deformed-Steel Welded Wire Fabric: ASTM A497, flat sheet.
- M. Epoxy-Coated Welded Wire Fabric: ASTM A884, Class A, plain steel.
- N. Epoxy-Coated Welded Wire Fabric: ASTM A884, Class A, deformed steel.

## 2.03 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
  1. For concrete surfaces exposed to view or weather where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
  2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.
- C. Epoxy-Coated Joint Dowel Bars: ASTM A775; with ASTM A615, Grade 60, plain-steel bars.
- D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775.
- E. Tie Wire: Minimum 16 gage annealed type.

## 2.04 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I.
- B. Portland Cement: ASTM C150, Type II.
- C. Portland Cement: ASTM C150, Type III. Permitted only for concrete exposed to weather.
- D. Portland Cement: ASTM C150, Type V.
  1. Fly Ash: ASTM C618, Class C or F.

2. Fly Ash: ASTM C618, Class F.
  3. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- E. Normal-Weight Aggregate: ASTM C33, uniformly graded, and as follows:
1. Class: Severe weathering region, but not less than 3S.
  2. Class: Moderate weathering region, but not less than 3M.
  3. Class: Negligible weathering region, but not less than 1N.
  4. Nominal Maximum Aggregate Size: 1-1/2 inches.
  5. Nominal Maximum Aggregate Size: 1 inch.
  6. Nominal Maximum Aggregate Size: 3/4 inch.
- F. Lightweight Aggregate: ASTM C330.
1. Nominal Maximum Aggregate Size: 1 inch.
  2. Nominal Maximum Aggregate Size: 3/4 inch.
  3. Nominal Maximum Aggregate Size: 1/2 inch.
  4. Nominal Maximum Aggregate Size: 3/8 inch.
- G. Water: Potable and complying with ASTM C94.

## 2.05 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C260.
- C. Water-Reducing Admixture: ASTM C494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
- G. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Preferred Manufacturers:
    - a. None.
  2. Approved Manufacturers:
    - a. "Catexol 1000CL"; Axim Italcementi Group, Inc. (800-899-8795)
    - b. "MCI 2000 or MCI 2005"; Cortec Corporation (800-426-7832)
    - c. "DCI or DCI-S"; W. R. Grace & Co., Construction Products Div. (800-778-2880)
    - d. "Rheocrete 222+"; BASF Building Systems (216-839-7000)
    - e. "FerroGard-901"; Sika Construction Products Division, Sika Corporation (800-933-7452)
    - f. "Eucon CIA"; Euclid Chemical Co, An RPM Company; (800-321-7628)

## 2.06 FIBER REINFORCEMENT

- A. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C1116, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. Fibrillated Fibers:
      - 1) "Fibermesh"; Fibermesh, Div. of Synthetic Industries; (423-892-7243)
      - 2) "Super-Net"; Forta Corporation; (800-245-0306)
      - 3) "Grace Fibers"; W. R. Grace & Co., Construction Products Div. (800-778-2880)
      - 4) "Fiberstrand F"; Euclid Chemical Co, An RPM Company; (800-321-7628)
    - b. Monofilament Fibers:
      - 1) "Fiberstrand 100"; Euclid Chemical Co, An RPM Company; (800-321-7628)



- 2) "Fibermix Stealth"; Fibermesh, Div. of Synthetic Industries; (423-892-7243)
- 3) "Mighty-Mono"; Forta Corporation; (800-245-0306)
- 4) "Grace MicroFiber"; W. R. Grace & Co., Construction Products Div.  
(800-778-2880)

## 2.07 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  1. Profile: Ribbed with center bulb.
- B. Preferred Manufacturers:
  1. None
- C. Approved Manufacturers:
  1. PVC Waterstops:
    - a. "PVC Waterstop"; Greenstreak, Inc.; (800-325-9504)
    - b. "Sealtight PVC Waterstops"; W. R. Meadows, Inc.; (800-342-5976)
    - c. Westec Barrier Technologies, Div. of Western Textile Products, Inc. (800-793-7832)
- D. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophilic material for adhesive bonding to concrete.
  1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Volclay Waterstop-RX"; CETCO, Subsidiary of AMCOL International Corp; (800-527-9948)
    - b. "Hydrotite"; Greenstreak, Inc.; (800-325-9504)
    - c. "Adeka Ultra Seal"; OCM, Inc. (800-999-3959)

## 2.08 VAPOR RETARDERS

- A. Refer to Section 07 10 00 for [vapor barrier] [vapor retarder] materials.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, Size 57, with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

## 2.09 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- B. Moisture-Retaining Cover: ASTM C171, .006 inch (6 mil) thick, polyethylene film or white burlap-polyethylene sheet.
- C. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  1. Material shall become an integral part of concrete surface and leave floor free of residue or film.
  2. Preferred Manufacturers:
    - a. None
  3. Approved Manufacturers:
    - a. "Eucobar"; Euclid Chemical Co, An RPM Company; (800-321-7628)
      - 1) VOC: 88 g/L
    - b. "Confilm"; BASF Building Systems (800-433-9517)
      - 1) VOC: 10 g/L
    - c. "SikaFilm"; Sika Construction Products Division, Sika Corporation (800-933-7452)
      - 1) VOC: g/L
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.
  1. Preferred Manufacturers:

- a. None
- 2. Approved Manufacturers:
  - a. "Cure & Seal 309 EF"; Dayton Superior; (800-745-3700)
    - 1) VOC: <100 g/L
  - b. "Aqua Cure VOX"; Euclid Chemical Co, An RPM Company; (800-321-7628)
    - 1) VOC: 184 g/L
  - c. "Glazecote 20"; Lambert Corp (800-432-4746)
    - 1) VOC: 79.3 g/L
  - d. "Kure-N-Seal WB"; BASF Building Systems (800-433-9517)
    - 1) VOC: 330 g/L
- F. Clear, Waterborne, Curing and Sealing Compound: ASTM C1315, 25% solids minimum.
  - 1. Approved Manufacturers:
    - a. "Cure & Seal 1315 EF"; Dayton Superior; (800-745-3700)
      - 1) VOC: <100 g/L
    - b. "Super Aqua Cure VOX"; Euclid Chemical Co, An RPM Company; (800-321-7628)
      - 1) VOC: <200 g/L
    - c. "Glazecoat 30"; Lambert Corp (800-432-4746)
      - 1) VOC: 145.4 g/L
    - d. "Clearseal WB 300"; Euclid Chemical Co, An RPM Company; (800-321-7628)
      - 1) VOC: 134 g/L
    - e. "Kure 1315"; BASF Building Systems (800-433-9517)
      - 1) VOC: 139 g/L

## 2.10 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber, or ASTM D1752, cork or self-expanding cork.
- B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D2240.
- C. Polyurea Joint Filler: Two-component, 100 percent solids, with a Shore A hardness of 80 per ASTM D2240.
- D. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. Epoxy-Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
  - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
  - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
  - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- F. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- G. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
  4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C109.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).
1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
  4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C109.

## 2.12 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
  1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
  2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Proportion concrete mix for each class of concrete to achieve the strengths (28 days) and slumps noted on the drawings.
- D. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  1. Fly Ash: 25 percent.
  2. Combined Fly Ash and Pozzolan: 25 percent.
  3. Ground Granulated Blast-Furnace Slag: 50 percent.
  4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- F. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete required to have low water permeability.
- G. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.
- H. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.
- I. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete subject to moderate sulfate exposure.
- J. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete subject to severe or very severe sulfate exposure.
- K. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
  1. Air Content: 5.5 percent for 1-1/2-inch- (38-mm-) nominal maximum aggregate size.
  2. Air Content: 6 percent for 1-inch- (25-mm-) nominal maximum aggregate size.
  3. Air Content: 6 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.
- L. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

- M. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- N. Micro-Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1 lb/cu. yd.
- O. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  - 4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

## **2.13 FABRICATING REINFORCEMENT**

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

## **2.14 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94 and ASTM C1116, and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## **EXECUTION**

### **3.01 FORMWORK**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch (3 mm).
  - 2. Class B, 1/4 inch (6 mm).
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
  - 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete unless otherwise noted or detailed on drawings.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.02 EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor bolts, accurately located, to elevations required.
  - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.
- B. Embedded items shall be located so as not to reduce the strength of the construction. They shall be thoroughly clean and free from coating, rust, scale, oil and other foreign material. No wood shall be permanently embedded in concrete.
- C. Embedments shall be maintained in position and protected until the concreting is complete.

### **3.03 REMOVING AND REUSING FORMS**

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
  - 1. At least 70 percent of 28-day design compressive strength.
  - 2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
  - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by [Architect] [Owner's Representative].

### **3.04 SHORES AND RESHORES**

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### **3.05 VAPOR RETARDERS**

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Place, protect, and repair vapor-retarder sheets according to ASTM E1643 and manufacturer's written instructions.
  - 1. At existing slab cuts repair existing vapor retarder. Splice in new material as required to provide continuous vapor retarder prior to patching concrete slab.
- B. Refer to Section 07 10 00 for [vapor barrier] [vapor retarder] for additional specifications.

### **3.06 STEEL REINFORCEMENT**

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963.
- G. Zinc-Coated Reinforcement: Use galvanized steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

### **3.07 JOINTS**

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by [Architect] [Owner's Representative].
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
  - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
  - 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.08 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

### 3.09 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by [Architect] [Owner's Representative].
- C. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- E. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
  - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
  - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to

consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- H. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
  - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### **3.10 FINISHING FORMED SURFACES**

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
  - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
  - 2. Do not apply rubbed finish to smooth-formed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished concrete:
  - 1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent



formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
  - 1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Owner's Representative before application.
- G. Slip-Resistive Aggregate Finish (where required by local codes): Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
  - 1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
  - 2. After broadcasting and tamping, apply float finish.
  - 3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

### 3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Other than specified in Section 32 13 13 (02751) Cement Concrete Pavement, provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

### 3.13 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. Restrictions on use: Do not use curing compound on surfaces over which homogeneous sheet material will be applied. For surfaces to receive other finishes, submit well in advance of time for curing application, written acceptance of curing compound by both the manufacturer and the installer of the finish material, relative to compatibility therewith of finish material, including primers, adhesives, and similar materials. If manufacturer of finish material has not been determined, Contractor shall be responsible for coordinating such acceptance.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial

application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### **3.14 JOINT FILLING**

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### **3.15 CONCRETE SURFACE REPAIRS**

- A. Defective Concrete: Repair and patch defective areas when approved by Owner's Representative. Remove and replace concrete that cannot be repaired and patched to Owner's Representative approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Owner's Representative.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Owner's Representative's approval, using epoxy adhesive and patching mortar.
  - F. Repair materials and installation not specified above may be used, subject to Owner's Representative's approval.

### 3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
  1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
  2. Slump: ASTM C143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C231, pressure method, for normal-weight concrete; ASTM C173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  4. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
  5. Unit Weight: ASTM C567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  6. When frequency of testing will provide fewer than five compressive-strength tests  
Compression Test Specimens: ASTM C31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
    - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
  7. Compressive-Strength Tests: ASTM C39; test two laboratory-cured specimens at 7 days and two at 28 days.
    - a. Test two field-cured specimens at 7 days and two at 28 days.
    - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no

compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

- E. Test results shall be reported in writing to [Owner's Representative,] [Architect,] concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by [Owner's Representative] [Architect] but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by [Owner's Representative] [Architect]. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by [Owner's Representative] [Architect].

**END OF SECTION**

**SECTION 03 54 13**  
**GYPSUM CEMENT UNDERLAYMENT**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Gypsum Cement Floor Underlayment.
  - 2. Removal of deteriorated Gypsum Cement Floor Underlayment and subsequent patching and rebuilding.
- B. Related Sections:

**1.02 REFERENCES**

- A. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)
  - 1. C472 "Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete".

**1.03 SUBMITTALS**

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

**1.04 QUALITY ASSURANCE**

- A. Installer's Qualifications: An experienced installer who is acceptable to manufacturer, who has completed cement-based underlayment applications similar in material and extent to that required for this Project, and whose work has resulted in construction with a record of successful in-service performance.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

**1.06 PROJECT CONDITIONS**

- A. Environmental Limitations: Comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.
- B. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.

**1.07 COORDINATION**

- A. Coordinate cement-based underlayment with requirements of finish flooring products, including adhesives, specified in Division 09 Sections.
  - 1. Before installing surface sealers recommended by underlayment manufacturer, if any, verify compatibility with finish flooring installation adhesives.

**1.08 PRODUCTS**

**1.09 MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Gyp-Crete 2000 with Maxxon Overspray Primer/Sealer"; Maxxon Corporation (800-356-7887)
  - 2. "Firm-Fill 3310 with Hacker TopCoat SP"; Hacker Industries, Inc. (800-642-3455)
  - 3. "LevelRock 2500 Floor Underlayment with SE-100 Surface Enhancer"; USG (United States Gypsum Company) (800-847-4431)

- C. Acceptable Manufacturers:
  - 1. "LevelRock 4500 NXG Floor Underlayment"; USG (United States Gypsum Company) (800-847-4431)
  - 2. "Dura-Cap with Maxxon Overspray Primer/Sealer"; Maxxon Corporation (800-356-7887)
  - 3. "Firm-Fill 4010 with Hacker TopCoat SP"; Hacker Industries, Inc. (800-642-3455)

#### **1.10 PRODUCTS AND MATERIALS**

- A. Gypsum Cement: Gypsum cement product as manufactured by listed manufacturers.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4", or coarse sand as recommended by underlayment manufacturer.
  - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 degrees F.
- D. Floor Primer and Sealer: Products of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

#### **1.11 MIXES: MIX PROPORTIONS AND METHODS SHALL BE IN STRICT ACCORDANCE WITH PRODUCT MANUFACTURER'S RECOMMENDATIONS.**

- A. Compressive strength of psi. Do not over water.

### **PRODUCTS**

#### **2.01 EXAMINATION**

- A. Examine substrates, with Installer present, for conditions affecting performance of underlayment including substrate moisture content. Begin underlayment application only after unsatisfactory conditions have been corrected.

#### **2.02 RESTORATION**

- A. Remove all damaged Gypsum Cement Underlayment in area of work.
- B. Saw cut perimeter of areas indicated for removal to depth of substrate without cutting through existing substrate. Make cuts perpendicular to underlayment surfaces. Remove all loose and deteriorated materials.
- C. If existing substrate is found to be in a deteriorated condition, notify the Owner's Representative in writing of the extent of the damaged areas. Remove damaged substrate materials to centerline of nearest structural member, and replace with matching materials of same thickness as original, as approved by Owner's Representative.

#### **2.03 PREPARATION**

- A. General: Prepare and clean substrate according to manufacturer's written instructions for substrate indicated. Provide clean, dry, neutral-pH substrate for underlayment application.
  - 1. Subfloor shall be structurally sound, clean, and free of mud, oil, grease, or other contaminants.
- B. Prior to installation of Gypsum Cement Underlayment, General Contractor shall inspect the area to be poured for proper attachment of the subfloor and replace any areas of subfloor that have weakened or delaminated during construction. All stud wall base plates in doors and other openings shall be removed.
  - 1. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
  - 2. Treat nonmoving substrate cracks to prevent cracks from telegraphing through underlayment according to manufacturer's written recommendations.
  - 3. Fill substrate voids to prevent underlayment from leaking.
  - 4. Verify that the subfloor deflection meets project specification.
- C. Priming Subfloor:

1. Spray one coat of Floor Primer with a concrete or garden sprayer over entire plywood deck using mix as recommended by underlayment. When applying underlayment over APA span-rated oriented strand or waferboard, apply conditioner and primer as required by underlayment manufacturer.

D. Expansion Joints: Allow joints to continue through the underlayment at same width.

#### **2.04 APPLICATION OF GYPSUM CEMENT UNDERLAYMENT**

- A. Scheduling: Application shall not begin until the building is enclosed, including roof, windows, doors, and other fenestration. Install after drywall installation.
- B. Application: Place underlayment at [1"] minimum over subfloor. Spread and screed to a smooth surface. Except at authorized joints, place underlayment as continuously as possible until application is complete so that no gypsum cement slurry is placed against underlayment product that has obtained its initial set.
- C. Curing: General Contractor shall provide continuous ventilation and adequate heat to rapidly remove moisture from the area until the underlayment is dry. Contractor shall provide mechanical ventilation if necessary. This Contractor shall test for dryness in the presence of the Owner's Representative utilizing the procedure as recommended by the underlayment manufacturer.

#### **2.05 PREPARATION FOR INSTALLATION OF GLUE DOWN FLOOR GOODS**

- A. Sealing: Seal all areas that receive glue according to the underlayment manufacturer's specifications. Any floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering to be used.
  1. Where floor goods manufacturers require special adhesive or installation systems, their requirements supersede these recommendations.

#### **2.06 FIELD QUALITY CONTROL**

- A. Slump Test: Gypsum cement mix shall be tested for slump as it's being pumped using a 2" x 4" cylinder for compliance with manufacturer's written recommendations.
- B. Field Samples: At least one set of three (3) molded cube samples shall be taken from each day's pour during the application. Cubes shall be tested as recommended by the underlayment manufacturer in accordance with ASTM C472 using split brass molds. Test results shall be available to the Architect, Owner's Representative and Contractor from applicator upon request.

#### **2.07 PROTECTION**

- A. During construction, contractor shall place temporary wood planking over underlayment wherever it will be subjected to heavy wheeled or concentrated loads.

**END OF SECTION**



**SECTION 04 20 00**  
**UNIT MASONRY**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Types of masonry work required include:
    - a. Standard Concrete Masonry Units
    - b. Face Brick
    - c. Stone Trim Units
    - d. Special Masonry Shapes
    - e. Mortar and Grout
    - f. Reinforcing Steel
    - g. Masonry Joint Reinforcement
    - h. Required Masonry Ties and Anchors
- B. Related Sections:
  - 1. Section 04 72 00 - Cast Stone Masonry
  - 2. Section 04 73 00 - Manufactured Stone Masonry
  - 3. Section 07 19 00 (07190) - Water Repellents
  - 4. Section 07 20 00 (07200) - Thermal Protection
  - 5. Section 07 62 00 (07620) - Sheet Metal Flashing and Trim
  - 6. Section 07 92 00 (07920) - Joint Sealants
- C. Products installed, but not furnished, under this Section include the following:
  - 1. [Steel Lintels] [and] [Shelf Angles] for unit masonry, furnished under Section 05 50 00, (05500) - Metal Fabrications.
  - 2. Hollow-metal frames in unit masonry openings, furnished under Section 08 11 13 (08110) - Hollow Metal Doors and Frames.

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. A82 "Standard Specification for Steel Wire, Plain, for Concrete Reinforcement"
  - 2. A185 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete"
  - 3. A307 "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength"
  - 4. A496 "Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement"
  - 5. A497 "Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete"
  - 6. A615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"
  - 7. A951 "Standard Specification for Masonry Joint Reinforcement"
  - 8. C67 "Test Methods of Sampling and Testing Brick and Structural Clay Tile"
  - 9. C90 "Standard Specification for Loadbearing Concrete Masonry Units"
  - 10. C140 "Test Methods of Sampling and Testing Concrete Masonry Units and Related Units"
  - 11. C144 "Standard Specification for Aggregate for Masonry Mortar"
  - 12. C216 "Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)"
  - 13. C270 "Standard Specification for Mortar for Unit Masonry"
  - 14. C404 "Standard Specification for Aggregates for Masonry Grout"
  - 15. C476 "Standard Specification for Grout for Masonry"
  - 16. C641 "Standard Test Methods for Mastics and Coatings Used With Thermal Insulation"
  - 17. C1314 "Standard Test Method for Compressive Strength of Masonry Prisms"
  - 18. D226 "Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing"

19. D2287 "Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds"
  20. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
  21. E514 "Test Method for Water Penetration and Leakage through Masonry"
- B. Joint American Concrete Institute (ACI) / American Society of Civil Engineers (ASCE) / The Masonry Society (TMS) Publications:
1. ACI 530-1/ASCE 6/TMS 602 "Specification for Masonry Structures"
  2. ACI 530/ASCE 5/TMS 402 "Building Code Requirements for Masonry Structures"
- C. National Concrete Masonry Association (NCMA) Publications:
1. "Tek" Bulletins

### 1.03 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the net-area compressive strengths at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- B. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.
- C. Fire Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies with fire-resistance ratings determined by testing in compliance with ASTM E119 by a recognized testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.
- C. Samples for Initial Selection: For the following:
  1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
  2. Colored mortar Samples showing the full range of colors available.
- D. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

### 1.05 QUALITY ASSURANCE

- A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602, "Specifications for Masonry Structures", except as otherwise indicated.
  1. Revise ACI 530.1/ASCE 6 to exclude Sections 1.5; Parts 1.6-A.1.b and 1.6-A.1.c; and Part 3.3-E.
- B. Fire Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies with fire-resistance ratings determined by testing in compliance with ASTM E119 by a recognized testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authority having jurisdiction.
- C. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each different product required for each continuous surface or visually related surfaces.
- D. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- E. Sample Panels: Before installing unit masonry, build sample panels, using materials indicated for the completed Work, to verify selection and to demonstrate aesthetic effects. Build sample

panels for each type of exposed unit masonry assembly in sizes approximately 48 inches long by 48 inches high by full thickness.

1. Locate panels in the locations indicated or, if not indicated, as directed by [Owner's Representative] [Architect] [a Hotel Representative].
  2. Clean exposed faces of panels with masonry cleaner indicated.
  3. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
  4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by the [Owner's Representative] [Architect] [Hotel Representative] in writing.
    - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by the [Owner's Representative] [Architect] [Hotel Representative] in writing.
  5. Demolish and remove sample panels when directed.
- F. Clay Masonry Unit Test: For each clay masonry unit indicated, per ASTM C67.
- G. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C140.
- H. Prism Test: For each type of wall construction indicated, per [ASTM C1314].

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver masonry materials to project in undamaged condition.
- B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- E. Store masonry accessories, including metal items, to prevent deterioration by corrosion and accumulation of dirt.
- F. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

#### **1.07 PROJECT/SITE CONDITIONS**

- A. Protection of Work: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
  2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform roof loading for at least 12 hours after building masonry walls or columns.
- C. Do not apply uniform roof or floor loading until the masonry has cured to the extent that it will safely support the intended load, a minimum of 12 hours after building masonry walls or columns.
- D. Do not apply concentrated loads until the masonry has cured to the extent that it will safely support the intended load, a minimum of 3 days after building masonry walls or columns.
- E. Staining: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by means of coverings spread on ground and over wall surface.
2. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

## **1.08 COLD AND HOT WEATHER PROTECTION**

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- B. Remove masonry damaged by freezing conditions.
- C. Cold Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:
  1. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F.
  2. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry.
  3. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F if grouting. Use heat on both sides of walls under construction.
  4. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F within the enclosures.
- D. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
  1. 40 to 25 deg F: Cover masonry with a weather-resistant membrane for 48 hours after construction.
  2. 25 to 20 deg F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h.
  3. 20 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after construction.
- E. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.
- F. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
  1. Comply with hot weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  2. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

## **PRODUCTS**

### **2.01 FACE BRICK: ASTM C216, GRADE SW, TYPE FBS ABSORPTION NOT MORE THAN 9% BY DRY WEIGHT PER ASTM C67.**

- A. General: Provide shapes indicated and as follows:

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.
2. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced".
3. Face Brick: [ASTM C216], Grade SW, Type FBS absorption not more than 9% by dry weight per ASTM C67.
  - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of [3000 psi] [4400 psi] [5500 psi] [6400 psi] [8000 psi] [8400 psi].
4. Size:
  - a. Refer to Exterior Finish Index.
  - b. Modular Size: 3-5/8 inches deep, 2-1/4 inches high, 7-5/8 inches long
5. Color:
  - a. Refer to Exterior Finish Index.
- B. Preferred Manufacturers:
  1. None
- C. Approved Manufacturers:
  1. Refer to Exterior Finish Index
  2. Belden Brick Company (330-456-0031)
  3. Endicott Clay Products Co. (402-729-3315)
  4. Glen-Gery Brick, an Oldcastle Company. (610-562-3076)
  5. Mutual Materials Co. (800-477-3008)
  6. [Insert local Manufacturer]

## 2.02 CONCRETE MASONRY UNITS

- A. Preferred Manufacturers:
  1. None
- B. Approved Manufacturers:
  1. Oldcastle Architectural Inc. (800-899-8455)
  2. [Insert local Manufacturer]
  3. Approved Substitution.
- C. General: Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.
  1. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
  2. Provide [bullnose] [square-edged] units for outside corners, unless indicated otherwise on the Drawings.
- D. Concrete Masonry Units: Provide units complying with characteristics indicated below for grade, type, face size, exposed face and, under each form of block included, for weight classification:
  1. Size:
    - a. Unless noted otherwise [on Exterior Finish Index], provide manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated.
  2. Exposed Faces:
    - a. Manufacturer's Standard Gray Color and Texture
    - b. [Color and Texture as selected by Owner's Representative from Manufacturer's Standard Colors]
    - c. [Color and Texture as selected by Owner's Representative from Manufacturer's Custom Colors]
    - d. Face Finish:
      - 1) Smooth
      - 2) [Split Face Finish]

- 3) [Split Face Finish, Center-Scored vertically so units laid in running bond appear as square units laid in stacked bond.]
- 4) [Center-Scored vertically so units laid in running bond appear as square units laid in stacked bond.]
- 5) [Triple-Scored vertically so units laid in running bond appear as vertical units laid in stacked bond (soldier courses).]
- 6) [Lightweight aggregate, ground finish.]
3. Hollow Loadbearing Block: ASTM C90, and as follows:
  - a. Weight Classification: Medium weight, minimum compressive strength of 2000 psi (net area).
4. Solid Loadbearing Block: ASTM C145, and as follows:
  - a. Weight Classification: Medium weight, minimum compressive strength of 2000 psi.
5. Integral Water Repellent: At exterior exposed units, provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.
  - a. Preferred Manufacturers:
    - 1) None
  - b. Approved Manufacturers:
    - 1) "Dry-Block"; W. R. Grace & Co., Construction Products Div (800-558-7066)
    - 2) "Eucon Blocktite"; Euclid Chemical Co, An RPM Company; (800-321-7628)

**2.03 FIRE RATINGS: WHERE FIRE RATINGS ON MASONRY WALLS ARE SHOWN ON THE DRAWINGS, THE CONTRACTOR SHALL MAKE CERTAIN THAT THE FIRE-RESISTANT UNITS TO BE USED QUALIFY FOR THE RATINGS.**

**2.04 STONE TRIM UNITS**

- A. Limestone: Indiana oolitic limestone as quarried in Lawrence, Monroe, and Owen counties, Indiana; complying with ASTM C568, Category II (medium density); and matching standards of the Indiana Limestone Institute of America's "Indiana Limestone Handbook" for the following:
  1. Grade: [Select] [Standard]
  2. Color: [Buff] [Gray] [Variegated]
  3. Finish: [Smooth] [Plucked] [Match Architect's sample]
- B. Cut stone accurately to shape and dimensions indicated, with exposed faces dressed true, and with beds and joints at right angles to face; comply with fabricating tolerances specified by the Indiana Limestone Institute of America.

**2.05 MORTAR AND GROUT MATERIALS**

- A. Colored Cement Product: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. LeHigh Cement Co. (800-523-5488)
    - b. Cemex (800-245-1705)
    - c. Custom Building Products (800-272-8786)
    - d. LaFarge Corporation (800-336-2490)
    - e. Essroc, Italcementi Group (800-245-1717)
  3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Use cement with synthetic iron oxide pigment only.
  4. Aggregate for Mortar: ASTM C144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
    - a. White-Mortar Aggregates: Natural white sand or ground white stone.

- b. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
- B. Aggregate for Grout: ASTM C404.
- C. Grout for Unit Masonry: Comply with ASTM C476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Minimum compressive strength shall be 2,500 psi in 28 days.
  - 1. Use fine grout in grout spaces less than 2" in horizontal direction, unless otherwise indicated.
  - 2. Use coarse grout (maximum 3/8" aggregate) in grout spaces 2" or more in least horizontal dimension, unless otherwise indicated.
- D. Water Repellent Admix:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Dry-Block System Mortar Additive"; W. R. Grace & Co., Construction Products Div (800-558-7066)
    - b. "Blocktite Mortar Admixture"; Euclid Chemical Co, An RPM Company; (800-321-7628)
  - 3. Mortar additive shall be used in Type M or S Mortar Only.
  - 4. For use with above grade colored Concrete Masonry Units with integral water repellent only. Not for use with Standard Gray Concrete Masonry Units or Face Brick.
- E. Mortar Color: See Exterior Finish Index.
- F. Water: Potable
- G. Cold Weather additives shall NOT be used.

## 2.06 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES

- A. General: Comply with [ASTM A 951].
- B. Materials: Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:
  - 1. Mill Galvanized Steel Wire: ASTM A82 for uncoated wire and with ASTM C641 for zinc coating of class indicated below:
    - a. Class 1 (0.40 oz. per sq. ft. of wire surface).
  - 2. Hot-Dip Galvanized, Carbon Steel Wire: ASTM A82 with ASTM A153 for zinc coating of class indicated below:
    - a. Class B-2.
- C. Joint Reinforcement: Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10', with prefabricated corner and tee units, and complying with requirements indicated below:
  - 1. Width: Fabricate joint reinforcement in units with widths of approximately 2" less than nominal width of walls and partitions as required to provide mortar coverage of not less than 5/8" on joint faces exposed to exterior.
  - 2. Wire Size for Side and Cross Rods: #9 Gauge
  - 3. For single-wythe masonry, provide type as follows with single pair of side rods:
    - a. Truss design with continuous diagonal cross rods spaced not more than 16" o.c.
  - 4. For multi-wythe masonry with cavity filled solid with mortar, provide type as follows:
    - a. Truss design with diagonal cross rods spaced not more than 16" o.c. and number of side rods as follows:
    - b. Number of Side Rods for Multiple-Wythe Concrete Masonry: One side rod for each face shell of concrete masonry back-up and of concrete masonry facing wythe.
  - 5. For multi-wythe masonry with cavity containing insulation and air space, provide type as follows:

- a. Ladder design with perpendicular cross roads spaced not more than 16" o.c. vertically and one pintle tie for each 1.77 square feet of wall area.
- b. Preferred Manufacturers:
  - 1) None
- c. Approved Manufacturers:
  - 1) "Ladur-eye"; Dur-O-Wal, A Dayton Superior Company (800-323-0090)
  - 2) "Lox-all Adjustable Eye Wire"; Hohmann & Barnard, Inc. (800-645-0616)
  - 3) "AA525"; Hohmann & Barnard, Inc. (800-645-0616)
- D. Flexible Anchors: Where flexible anchors are indicated for connecting masonry to structural framework, provide 2-piece anchors, as described below, which permit vertical or horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall.
  - 1. Masonry Veneer Anchors: Two-piece assemblies which permit vertical or horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall, consisting of wire tie section and metal anchor section for attachment over sheathing to metal studs and complying with the following requirements:
    - a. Wire Size: 0.1875" Diameter
    - b. Wire Tie Shape: Rectangular with Cavity Drip
    - c. Wire Tie Length: As Required to Extend Within 1-1/2" of Masonry Wythe of Veneer Face
  - 2. Control Joint Anchors: Corrugated galvanized steel, 6-1/4" long x 1" wide x 24 gauge, with 1/4" wide x 1-3/4" deep V-groove.
- E. Anchor Section: Sheet metal plate, with screw holes top and bottom and with raised, rib-stiffened strap stamped into center to provide slot between strap and plate for connection of wire tie, of overall size and thickness indicated below:
  - 1. Size: Plate and strap size: 1-1/4" wide for plate, 5/8" for strap x lengths indicated below. Slot clearance formed between face of plate and back of strap at maximum rib projection: 1/32" + diameter of wire tie.
  - 2. Plate and Strap Lengths: 5" and 3-5/8", with both sides of plate stiffened by ribs.
  - 3. Thickness: 0.0747" (14 Gauge)

## 2.07 REINFORCING STEEL

- A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.
- B. Steel Reinforcing Bars: Material and grade as follows:
  - 1. Billet steel complying with ASTM A615, Grade 60.
- C. Deformed Reinforcing Wire: ASTM A496.
- D. Plain Welded Wire Fabric: ASTM A185.
- E. Deformed Welded Wire Fabric: ASTM A497.

## 2.08 ACCESSORIES

- A. Premolded Control Joint Strips: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall. Size and configuration as indicated.
  - 1. Polyvinyl Chloride Complying with ASTM D2287, General Purpose Grade, Designation PVC-63506.
    - a. Preferred Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) "AA2000-2001 Blocktite"; Hohmann & Barnard, Inc. (800-645-0616)
      - 2) "Rapid Poly-Joint"; Dur-O-Wal, A Dayton Superior Company (800-323-0090)
- B. Bond Breaker Strips: Asphalt-Saturated Organic Roofing Felt Complying with ASTM D226, Type I (No. 15 Asphalt Felt)



- C. Weepholes: Provide the following for weepholes:
1. Round Plastic Weep/Vent Tubing: Medium Density Polyethylene with Rope Insert, Outside Diameter and Length as Indicated Below:
    - a. 3/8" o.d. x 4" long
  2. Louvered Weep Hole:
    - a. Preferred Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) "Model No. [343] [343W (White)]"; Hohmann & Barnard, Inc. (800-645-0616)
      - 2) Approved Substitution
  3. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
    - a. Products:
      - 1) "Mortar Maze Weep Vent "; Advanced Building Products, Inc. (800-252-2306)
      - 2) "Cell Vents "; Dur-O-Wal, A Dayton Superior Company (800-323-0090)
      - 3) "Quadro-Vent"; Hohmann & Barnard, Inc. (800-645-0616)
      - 4) "No. 85 Cell Vent"; Heckmann Building Products Inc.
      - 5) "Cell Vent "; Wire-Bond;
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units shall be formed from [0.187-inch] steel wire, hot-dip galvanized after fabrication.
1. Provide units with either two loops or four loops as needed for number of bars indicated.
  2. Preferred Manufacturers:
    - a. None
  3. Approved Manufacturers:
    - a. "D/A 811"; Dur-O-Wal, A Dayton Superior Company (800-323-0090)
    - b. "D/A 816"; Dur-O-Wal, A Dayton Superior Company (800-323-0090)
    - c. "#RB Rebar Positioner"; Hohmann & Barnard, Inc. (800-645-0616)
    - d. "#RB-Twin Rebar Positioner"; Hohmann & Barnard, Inc. (800-645-0616)
- E. Cavity Drainage Material: [3/4-inch] [1-inch] [2-inch] thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Mortar Break"; Advanced Building Products, Inc. (800-252-2306)
    - b. "CavClear Masonry Mat"; CavClear / Archovations, Inc. (715-381-5773)
    - c. "Mortar Net"; Mortar Net USA, Ltd. (800-664-6638)
- F. Flashings:
1. Refer to Section 07 62 00 (07620) - Sheet Metal Flashing & Trim for flashing materials.
- G. Flashing Termination Drip Plates
1. Approved Manufacturers:
    - a. "Foam-Tite Seal Model No.FTSA"; Hohmann & Barnard, Inc. (800-645-0616)
- H. Anchor Bolts: Provide steel bolts wit hex nuts and flat washers complying with ASTM A307, Grade A, hot-dip galvanized to comply with ASTM C153, Class C, in sizes and configuration indicated.
- I. Masonry-Cell Insulation
1. Loose-Granular Fill Insulation: Perlite complying with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
  2. Loose-Fill Insulation Cell Mesh: Provide block cell mesh every third block course, designed to control loose fill insulation in block wall cells. 10 x 10 mesh coated fiberglass.

- a. Approved Manufacturers:
  - 1) "DA1010 Fil-Stop"; Dur-O-Wal, A Dayton Superior Company (800-323-0090)
  - 2) "MGS - Mortar/Grout Screen"; Hohmann & Barnard, Inc. (800-645-0616)

## 2.09 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard strength general purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated; composed of blended organic and inorganic acids combined with special wetting systems and inhibitors; expressly approved for intended use by manufacturer of masonry units being cleaned without damaging or discoloring masonry surfaces.
- B. Preferred Manufacturers:
  - 1. None
- C. Approved Manufacturers:
  - 1. "Sure Klean No. 600 Detergent"; ProSoCo, Inc. (800-255-4255)
  - 2. "202 New Masonry Detergent"; Diedrich Technologies, Inc. (800-323-3565)

## 2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification, for types of mortar required, unless otherwise indicated.
  - 1. [Use Type mortar as shown on Drawings.
    - a. Minimum compressive strength as shown on Drawings.]
  - 2. For masonry below grade, in contact with earth, and where indicated, use Type - [M] [M or RM] [S] [S or RS].
  - 3. For reinforced masonry and where indicated, use Type - [S] [S or RS] [N] [N or RN].
  - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type - [N].
  - 5. For mortar parge coats use Type N.
- D. Colored Pigmented Mortar: Select and Proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1-to-10, by weight. Color as selected by Owner's Representative.
- E. Grout for Unit Masonry: Comply with ASTM C476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
  - 2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
  - 3. Provide grout with a slump of [8 to 11 inches] [10 to 11 inches] as measured according to ASTM C143.

## 2.11 SOURCE QUALITY CONTROL

- A. Contractor will engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made [by Hotel] [by Owner] [Contractor using a Testing Agency as approved by Hotel and the Architect] [Contractor using a Testing Agency as approved by the Owner and Architect].
  2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C67.
- C. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C140.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Verify that foundations are within tolerances specified.
  2. Verify that reinforcing dowels are properly placed.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

### **3.02 INSTALLATION - GENERAL**

- A. Do not wet concrete masonry units.
- B. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.
- C. Thickness: Build cavity and composite walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness indicated.
- D. Build chases and recesses to accommodate items specified in this Section or in other sections of the Specifications as shown or required. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- E. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.
- F. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible.
1. Use dry cutting saws to cut concrete masonry units.
- G. Select and arrange units for exposed unit masonry to provide a uniform blend of colors and textures.
- H. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

### **3.03 CONSTRUCTION TOLERANCES**

- A. Comply with tolerances in ACI 530-1/ASCE 6/TMS 602 and the following:
1. Variation from Plumb: For vertical lines and surfaces of columns, walls and arises do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20'. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints, do not exceed plus or minus 1/4" in 10'.
  2. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls, do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.

3. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.
4. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

### **3.04 LAYING MASONRY WALLS**

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.
- B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
- C. Bond Pattern: Lay exposed masonry in the bond pattern shown or, if not shown, lay in [running] [stacked] bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back 1/2-unit length for 1/2-running bond or 1/3-unit length for 1/3 running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.
- E. Built-in Work: As construction progresses, build-in items specified under this and other Sections of these Specifications. Fill in solidly with masonry around built-in items.
  1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
  2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
  3. Fill cores in hollow concrete masonry units with grout 24" under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.
- F. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
  1. Install compressible filler in joint between top of partition and underside of structure above.
  2. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 07 Section "Firestopping."

### **3.05 MORTAR BEDDING AND JOINTING**

- A. Lay solid masonry units and brick units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
  1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.
- B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- C. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.
- D. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise indicated.

- E. All exposed joints shall be well-tooled to a concave or rodded profile, unless otherwise indicated.
  - 1. Provide raked joints at all vertical scores in scored brick units. Strike to match concave or rodded profile of horizontal joints.
  - 2. Rake-out expansion joints and joints indicated on Drawings to receive sealant.
- F. Mortar joints shall be struck at a consistent time interval when mortar is at the same medium stiff consistency in order to minimize color variations.
- G. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.
- H. Collar Joints: After each course is laid, fill the vertical longitudinal joint between wythes solidly and with mortar for the following masonry work:
  - 1. All exterior walls, except cavity walls, and interior walls and partitions.
- I. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes. Install at not more than 16" o.c. vertically.
- J. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.
- K. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:
  - 1. Provide individual metal ties at not more than 24" o.c. vertically.
- L. Provide weep holes in exterior wythe of cavity wall located immediately above ledges and flashing, spaced 2'-0" o.c., unless otherwise indicated.

### **3.06 CAVITIES**

- A. Keep cavities clean of mortar droppings and other materials during construction.
  - 1. Install Cavity Drainage Material in cavities in accordance with manufacturer's recommendations.
  - 2. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
- B. Apply air barrier to face of backup wythe to comply with Section 07 20 00 - "Thermal Protection."
- C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately [12 inches] o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
  - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

### **3.07 STONE TRIM UNITS**

- A. Set stone trim units in full bed of mortar with vertical joints slushed full. Fill dowel, anchor, and similar holes solid. Wet stone-joint surface thoroughly before setting; for soiled stone surfaces, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

### **3.08 MASONRY JOINT REINFORCEMENT**

- A. General: Provide continuous masonry joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls. Lap reinforcing a minimum of 6".
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Reinforce walls with continuous horizontal joint reinforcing, unless specifically noted to be omitted.

- D. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- E. Space continuous horizontal reinforcement as follows:
  - 1. For multi-wythe walls (solid or cavity) which are structurally bonded by masonry headers or individual wire ties, space horizontal reinforcement 24" o.c. vertically.
  - 2. For single-wythe walls, space reinforcement at 16" o.c. vertically, unless otherwise indicated.
  - 3. For parapets, space reinforcement at 8" o.c. vertically, unless otherwise indicated.
- F. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening, except at control joints.
  - 1. In addition to wall reinforcement, provide additional reinforcement at openings as required to comply with the above.

### **3.09 ANCHORING MASONRY WORK**

- A. General: Provide anchor devices of type indicated.
- B. Anchor single wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:
  - 1. Fasten each anchor section through sheathing to metal studs with two metal fasteners of type indicated.
  - 2. Embed tie section in masonry joints. Provide not less than 1" air space between back of masonry veneer wythe and face of sheathing.
  - 3. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.
  - 4. Space anchors as indicated, but not more than 16" o.c. vertically and 24" o.c. horizontally. Install additional anchors within 1'-0" of openings and at intervals around perimeter not exceeding 3'-0".
- C. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
  - 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.
- D. Anchor masonry veneers to concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
  - 1. Fasten anchors to concrete and masonry backup with metal fasteners of type indicated.
  - 2. Embed connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
  - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
  - 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and [32 inches] [24 inches] o.c. horizontally with not less than 1 anchor for each [3.5 sq. ft.] [2.67 sq. ft.] of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

### **3.10 CONTROL AND EXPANSION JOINTS**

- A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.

- B. Control Joint Spacing: If location of control joints is not shown, place vertical joints spaced not to exceed 30'-0" o.c. for concrete masonry wythes if reinforced, or 20'-0" o.c. if not reinforced. Locate control joints at points of natural weakness in the masonry work.
- C. Build-in non-metallic joint fillers where indicated.

### **3.11 LINTELS**

- A. Provide masonry lintels where shown and wherever openings of more than 2'-0" for block size units or more than 1'-0" for brick size units are shown without structural steel or other supporting lintels.
  - 1. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.
- B. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

### **3.12 FLASHING OF MASONRY WORK**

- A. General: Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.
  - 1. Refer to Division 07 Specification Sections for flashing materials.
- B. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2". At heads and sills, turn up ends not less than 2" to form a pan. Extend flashing on exterior to 1/4 inch past wall surface. Do NOT cut flush with wall.
- C. Install flashing to comply with manufacturer's instructions.
- D. Install weep holes in the exterior widths of the head joints of the first course of masonry immediately above embedded flashings. Space 24" o.c. unless otherwise indicated.

### **3.13 PARGING**

- A. Parge inside face of firepit wall.

### **3.14 REPAIRING, POINTING AND CLEANING**

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Install new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel. Leave 1/2 panel uncleaned for comparison purposes. Obtain Owner's Representative approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.
  - 4. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

### **3.15 PROTECTION**

- A. Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

**END OF SECTION**



**SECTION 04 72 00**  
**CAST STONE MASONRY**

**GENERAL**

**1.01 SUMMARY:**

- A. Section includes:
  - 1. Cast Stone Building Units
    - a. Cast Stone Wall Caps
    - b. Anchors and accessories for Cast Stone Units
    - c. Engineering design and detailing for cast stone veneer anchoring and support system.
- B. Related Sections
  - 1. Section 04 20 00 (04810) - Unit Masonry (for Mortar and Grout Material)
  - 2. Section 07 62 00 (07620) - Flashing and Sheet Metal
  - 3. Section 07 92 00 (07920) - Joint Sealants

**1.02 REFERENCES**

- A. American Concrete Institute (ACI) Publications:
  - 1. 318 "Building Code Requirements for Structural Concrete"
- B. ASTM International (ASTM) Publications:
  - 1. A82 "Standard Specification for Steel Wire, Plain, for Concrete Reinforcement"
  - 2. A123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"
  - 3. A153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
  - 4. A184 "Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement"
  - 5. A185 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete"
  - 6. A307 "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength"
  - 7. A615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete"
  - 8. C33 "Standard Specification for Concrete Aggregates"
  - 9. C150 "Standard Specification for Portland Cement"
  - 10. C173 "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method"
  - 11. C231 "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method"
  - 12. C260 "Standard Specification for Air-Entraining Admixtures for Concrete"
  - 13. C270 "Standard Specification for Mortar for Unit Masonry"
  - 14. C494 "Standard Specification for Chemical Admixtures for Concrete"
  - 15. C618 "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete"
  - 16. C666 "Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing"
    - a. C979 "Standard Specification for Coloring Pigments for Integrally Pigmented Concrete"
    - b. C989 "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete"
  - 17. C1194 "Standard Test Method for Compressive Strength of Architectural Cast Stone"
  - 18. C1195 "Standard Test Method for Absorption of Architectural Cast Stone"
  - 19. C1364 "Standard Specification for Architectural Cast Stone"
  - 20. D2244 "Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates"
- C. Cast Stone Institute Publications:
  - 1. Technical Manual (Current Edition)

### 1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Fabricate and install cast stone to withstand loads from wind, gravity, movement of building structure, and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.
  - 1. The Cast Stone Fabricator shall provide Sealed Engineer's Drawings and is responsible for the design and detailing of all anchors, supports and other items associated with the cast stone veneer assembly and its attachment to the structure.
  - 2. Contractor shall coordinate all requirements of anchoring systems with masonry and back-up panels beyond.
- B. Provide hand-set (field-installed) anchoring system, including connections to building structure that is capable of sustaining forces generated by gravity loads, wind loads, and stresses induced by thermal movement, acting separately or in combination, within the following parameters:
  - 1. For Cast Stone: Without exceeding allowable working stresses of cast stone. Determine the capacity of cast stone to sustain anchor loads by dividing the cast stone's average ultimate strength, as established by test, by cast stone's safety factor for anchor loads.
- C. Provide Cast Stone Masonry units for full-bed masonry veneer installation as indicated on the Drawings.
- D. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C666, Procedure A, as modified by ASTM C1364.

### 1.04 DEFINITIONS

- A. Cast Stone: Architectural pre-cast stone units intended for non-structural lightweight veneer facing to simulate natural stone.

### 1.05 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00.
- B. Product data for each type of cast stone, stonework accessories, and other manufactured products required.
- C. Shop drawings detailing fabrication and installation of cast stone cladding. Include setting Drawings indicating sizes, dimensions, sections, and profiles of stones, arrangement, and provisions for jointing, supporting, anchoring, and bonding stonework, and details showing relationship with, attachment to, and reception of related work.
  - 1. Include large-scale details of decorative surfaces and inscriptions.
  - 2. Include building elevations showing layout of units and locations of joints and anchors.
  - 3. Sealed Engineering design drawings
- D. Samples for verification purposes of cast stone in form of sets for each color, grade, finish, type, and variety of cast stone required and consisting of stones not less than 12 inches square.
  - 1. Colored pointing mortar and grout samples for each color required showing full range of exposed color and texture to be expected in completed work.
- E. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.

### 1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility for Cast Stone: Obtain each color, grade, finish, type, and variety of cast stone units from a single manufacturer with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to mold and finish material without delaying the progress of the work.
- B. Single-Source Responsibility for Mortar and Grout Materials: Obtain mortar ingredients of uniform quality and from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

- C. Single-Source Responsibility for Other Materials: Obtain each type of cast stone accessory, sealant, and other materials from one manufacturer for each product.
- D. Installer Qualifications; Engage an experienced installer who has completed cast stone cladding similar in material, design, and extent to that indicated for project that has resulted in construction with a record of 5 years of successful in-service performance.
  - 1. Installer shall engage a qualified Professional Engineer to provide sealed engineering drawings for system design including all anchors, supports and other items associated with the cast stone veneer assembly and its attachment to the structure.
- E. Field-Constructed Mock-Up: Prepare mock-ups for the following types of cast stone work. Purpose of mock-ups is further verification of selections made for color and finish under sample submittals and establishing standard of quality for aesthetic effects expected in completed work. Build mock-ups to comply with following requirements:
  - 1. Locate mock-ups on site where indicated or, if not indicated, as directed by [Owner's Representative] [Architect].
  - 2. Build mock-ups for the following types of cast stone work:
    - a. Typical exterior cast stone units of each type, full size in conjunction with mock-up for face brick.
    - b. Notify [Owner's Representative] [Architect] one week in advance of the dates and times when mock-ups will be erected.
    - c. Mockups may be incorporated into the work. If not, retain mock-ups during construction as standard for judging completed cast stone work. When directed, demolish mock-ups and remove from site.
- F. Comply with requirements of the Cast Stone Institute Technical Manual and the Project Specifications.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the Work.
- B. Deliver cast stone materials to Project in undamaged condition in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store and handle cast stone and related materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, chipping, or other causes.
  - 1. Do not use pinch or wrecking bars.
  - 2. Lift with wide-belt-type slings where possible. Do not use wire rope or ropes containing tar or other substances that might cause staining. If required to move cast stone, use wood rollers with cushions at end of wood slides.
  - 3. Store cast stone on wood skids or pallets covered with nonstaining, waterproof membrane. Place and stack skids and cast stone units to distribute weight evenly and to prevent breakage or cracking of cast stone units.
  - 4. Protect cast stone stored from weather with waterproof, nonstaining covers or enclosures, but allow air to circulate around stones.
  - 5. Store cementitious materials off the ground, under cover, and in dry location.
  - 6. Do not use salt or calcium chloride to remove ice from cast stone surfaces.

#### **1.08 PROJECT/SITE CONDITIONS**

- A. Protection of Work: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed cast stone when construction is not in progress.
- B. Staining: Prevent grout, mortar, and soil from staining the face of cast stone to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such cast stone.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by means of coverings spread on ground and over wall surface.

- C. Environmental Requirements:
  - 1. Ambient air temperature shall be in accordance with manufacturer's requirements.
  - 2. Maintain materials and surrounding air temperature to minimum 40 degrees prior to, during, and for 48 hours after completion of work.
  - 3. Protect materials from rain, moisture, and freezing temperatures prior to, during, and after 48 hours after completion of work.

## PRODUCTS

### 2.01 CUSTOM CAST STONE WALL CAPS

- A. Avendra, LLC Preferred Manufactures:
  - 1. None
- B. Approved Manufacturers:
  - 1. Custom Cast Stone Inc. (888-776-9960)
  - 2. RockCast Custom Cast Stone, a Division of Reading Rock Inc. (513-874-2345)
  - 3. Edwards Cast Stone Company (800-992-9323)
  - 4. Continental Cast Stone (856-753-4000)
  - 5. Advanced Cast Stone, Inc. (800-687-4352)
  - 6. United Cast Stone Co. (940-383-2332)
- C. Basis of Design Products: Subject to Compliance with requirements provide products by Custom Cast Stone Inc. (888-776-9960) or a substitution approved prior to bidding by a listed manufacturer for the following items:
  - 1. Shapes and sizes:
    - a. Wall Cap: [Refer to Drawings] [Insert size]
    - b. Corners: Provide corners with finished faces.
- D. Locations: As indicated on Drawings.

### 2.02 MATERIALS

- A. General: Comply with referenced standards and other requirements indicated applicable to each type of material required.
- B. Cast Stone: ASTM C1364.
  - 1. Casting Method: Vibrant Dry Tamp.
  - 2. Compressive Strength, ASTM C1194: 6,500 psi minimum at 28 days.
  - 3. Absorption, ASTM C642 or C1195: 6 percent maximum at 28 days
- C. Physical properties: Provide the following:
  - 1. Compressive Strength - ASTM C1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
  - 2. Absorption - ASTM C1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products at 28 days.
  - 3. Air Content - ASTM C173 or C 231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments.
- D. Cast Stone Materials
  - 1. Portland Cement: ASTM C150, Type I, white or gray as required to match specified color.
  - 2. Fine Aggregate: ASTM C33, graded and washed stone, gradation required to attain indicated textures and finishes.
  - 3. Coarse Aggregate: ASTM C33, graded and washed natural stone gradation required to attain indicated textures and finishes.
  - 4. Color Pigments: ASTM C979, inorganic iron oxide pigments, lime-proof. Cement grade carbon black pigment is not acceptable.
  - 5. Admixtures: Comply with ASTM C494, C260, C618, C989
  - 6. Water: Potable, free of impurities.
  - 7. Reinforcing:
    - a. ASTM A615, Grade 40 or 60; epoxy coated when embedment is less than 2 inches (51 mm) for #6 or larger bars; 1-1/2 inches (38 mm) for #5 or smaller bars.

- b. Steel Wire Reinforcement: ASTM A82.
  - c. Welded Wire Fabric: Comply with ASTM A185, where applicable.
  - d. Steel Bar or Rod Mat Reinforcement: Comply with ASTM A184, where applicable.
- E. All anchors, dowels and other anchoring devices and shims shall be non-corrosive type, sized for conditions, standard building stone anchors commercially available in stainless steel Type 302, or 304.

### 2.03 ACCESSORIES

- A. Clips, Plates, and Miscellaneous Anchors: ASTM Type 304 or 316 stainless steel for items in direct contact with cast stone, unless specifically indicated otherwise.
  - 1. Anchoring veneer to miscellaneous substrates: Stainless steel angles and split-tail anchors.
  - 2. Anchors to concrete or concrete masonry backup: Bolts with expansion shields.
  - 3. Corners: Cramp anchors for anchoring cast stone units together.
- B. Bolts: ASTM A 307, galvanized in accordance with ASTM A153, unless otherwise indicated.
- C. Other Fasteners: Stainless steel or steel galvanized after fabrication in accordance with ASTM A123.
- D. Setting Buttons, Shims, and Sheet: Lead or resilient plastic, nonstaining, thickness to suit joint thickness. For pointed joints, sized to avoid interference with pointing operation.
- E. Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

### 2.04 MORTAR AND GROUT

- A. Refer to Section 04 20 00 (04810) - Unit Masonry for Mortar and Grout Materials.

### 2.05 CAST STONE FINISH

- A. Color: [As shown on Exterior Finish Index] [As selected by [Owner's Representative] [Architect] from manufacturers full range].
  - 1. Finish exposed faces and edges of cast stone to comply with requirements indicated for finish.
- B. Surface Texture:
  - 1. Fine grained texture, similar to natural stone.
  - 2. No bugholes, air voids, or other surface blemishes.
- C. Color Variation:
  - 1. Viewing Conditions: Compare in direct daylight at 10 feet (3 m), between components of similar age, subjected to comparable weathering conditions.
  - 2. Maximum Variation, ASTM D2244

### 2.06 CAST STONE FABRICATION

- A. General: Fabricate cast stone in sizes and shapes required to comply with requirements indicated, including details on Drawings and final shop drawings.
  - 1. Comply with recommendations of the Cast Stone Institute.
- B. Cut and drill sinkages and holes in stones for anchors, fasteners, supports, and lifting devices as indicated or needed to set units securely in place. Set beds to fit supports.
- C. Tolerances: Comply with Cast Stone Institute recommendations and the following:
  - 1. Height and Width: Plus 1/16 inch; minus 1/8 inch
  - 2. Lengths:
    - a. Up to 2 feet, 0 inches: Plus 1/16 inch; minus 1/8 inch.
    - b. From 2 feet, 0 inches to 5 feet, 0 inches: Plus or minus 1/8 inch.
    - c. From 5 feet, 0 inches to 10 feet, 0 inches: Plus 1/8 inch; minus 3/16 inch.

- d. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features - On formed sides of unit, 1/8 inch, on unformed sides of unit, 3/8 inch maximum deviation.
  - e. Warp, bow or twist of units shall not exceed length/ 360 or  $\pm 1/8$  inch, whichever is greater.
- D. Design Mix: Cast stone manufacturer is responsible for preparing design mix to attain compressive strength of 6,500 psi at 28 days when tested in accordance with referenced requirements.
- E. Water Absorption: Maximum 4 percent by dry weight when tested according to specification requirements.
- F. Reinforcing: Place according to Cast Stone Institute recommendations for safe handling, setting and structural requirements, and as indicated on approved shop drawings.
  - 1. Panels, soffits and similar stone units greater than 24-inches in one direction shall be reinforced in that direction. Units less than 24-inches in both their length and width dimension shall be non-reinforced unless otherwise specified.
  - 2. Do not use welded wire fabric reinforcing in dry-cast products.
- G. Curing: After manufacturing, cure all dry-tamped cast stone minimum of 8 hours in a totally enclosed curing room at 85 degrees F and 100 percent relative humidity; then steam cure for minimum 10 hours.
- H. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.
- I. Fabricate molded work, including washes and drips, to produce cast stone shapes having a uniform profile throughout their entire length and with precisely formed arises slightly eased to prevent snapping, and matched at joints between units.
- J. Finish exposed faces and edges of stones to comply with requirements indicated for finish under each type and application of cast stone required and to match approved samples and field-constructed mock-ups.
- K. Carefully inspect finished cast stone units at fabrication plant for compliance with requirements relative to qualities of appearance, material, and fabrication. Replace defective cast stone units with ones that do comply.

## **2.07 SOURCE QUALITY CONTROL**

- A. Testing: For new design mixes, take daily test cylinders and test in-house, using a certified technician, at 20 hours, and 28 days after manufacturer to ensure compliance with minimum compressive strength requirements.
  - 1. Cast stone manufacturer will not be required to re-test previously tested and installed standard design mixes.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine surfaces to receive cast stone work, and conditions under which materials will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cast stone work. Do not proceed with installation until unsatisfactory conditions have been corrected.
  - 1. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of cast stone work.

### **3.02 PREPARATION**

- A. Advise installers of other work about specific requirements relating to placement of inserts, flashing reglets, and similar items to be used by cast stone installer for anchoring, supporting, and flashing of cast stone. Furnish installers of other work with Drawings or templates showing locations of these items.
- B. Verify items provided by other sections of work are properly sized and located.

- C. Protect work during erection as follows:
  - 1. Prevent staining of cast stone from mortar, grout, sealants, and other sources. Immediately remove such materials from cast stone without damage to latter.
  - 2. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
  - 3. Protect sills, ledges, and projections from droppings of mortar and sealants.
- D. Clean cast stone surfaces that have become dirty or stained prior to setting to remove soil, stains, and foreign materials. Clean cast stone units by thoroughly scrubbing units with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh filler or abrasives. Methods of cleaning shall be approved by cast stone manufacturer.

### 3.03 ERECTION

- A. General: Install/set all units and accessories accurately, using skilled, experienced personnel, according to approved shop and setting drawings. Use stone-fitters to perform field-cutting with power saws, when required. Clean cast stone surfaces before setting, using only water or mild cleaning compounds containing no caustic or abrasives.
  - 1. Clean cast stone surfaces before setting, using only water or mild cleaning compounds containing no caustic or abrasives.
  - 2. Drench all cast stone units thoroughly with water just before setting.
  - 3. Provide chases, reveals, openings, and other spaces required to accommodate other work. Close up after other work is complete with cast stone which matches cast stone already set.
  - 4. Where an open cavity is indicated between cast stone and backup material, keep cavity free of mortar and grout.
  - 5. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure cast stone work in place. Attach anchors securely to cast stone and to supporting surfaces. Place anchors and dowels firmly and fill holes with mortar or non-shrink grout.
  - 6. Set cast stone accurately, in patterns and locations indicated, with uniform joints of dimensions indicated, and with edges and faces aligned according to established relationships and indicated tolerances.
  - 7. Shim and adjust anchors, supports, and accessories.
  - 8. Set cast stone units supported on solid structural members on setting buttons, shims, or sheets, or a combination of setting buttons, and mortar.
  - 9. After setting each cast stone, rake all joints; sponge off mortar smears and splashes.
  - 10. Embed only ends of lugged sills and similar cast stone units; leave remainder of joint open and tuckpoint on faces only.
  - 11. Set all partially or fully horizontal cast stone units with unfilled vertical joints. After setting, install backer rod, prime ends and caulk.
- B. Setting Tolerances: Set cast stone units to the following tolerances unless detailed otherwise:
  - 1. Variation from level of grades indicated for floors, lintels, and sills.
  - 2. Variation of linear building lines from position in plan:
  - 3. Variation in cross-sectional dimensions of column and wall thickness:
    - a. From dimensions indicated, maximum minus 1/4 inch to plus 1/2 inch.
    - b. Variation between faces of adjacent pieces and panels is not permitted.
- C. Pointing: Before pointing, clean all faces to remain exposed with fiber brushes, soap powder and clean water. Rinse thoroughly.
  - 1. Point joints with pointing mortar in 3 layers. Place 2 layers, each filling approximately two-fifths of joint depth. Fill remaining joint depth with third layer. Compact each layer fully and allow to become thumbprint hard before applying next layer.
- D. Tooling: Tool joints when mortar is thumbprint hard with round joiner having a diameter 1/8 inch larger than width of joint.

### **3.04 ADJUSTING AND CLEANING**

- A. General: Perform final cleaning as soon as possible after mortar has set and been tooled. Clean faces of cast stone at pointed joints immediately. Remove soiled areas, streaks and stains from prefinished panels using clean water and soft bristle brush, followed by clear water rinse.
- B. Use no wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods which could damage, discoloration, etching of surfaces or joints, without written approval from cast stone manufacturer.
  - 1. Consult with manufacturer for appropriate cleaners.
  - 2. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Remove and replace or repair cast stone work with touchup materials furnished by manufacturer of the following description:
  - 1. Broken, chipped, stained, or otherwise damaged cast stone units. Broken, chipped, stained, or otherwise damaged cast stone units may be repaired, providing the methods and results are acceptable to [Owner's Representative] [Architect].
  - 2. Defective joints.
  - 3. Cast stone units and joints not matching approved samples and field-constructed mock-up.
  - 4. Cast stone work not complying with other requirements indicated.
- D. Acceptable Appearance: Cast Stone shall show no obvious repairs or imperfections, other than minimal color variations, when viewed with the unaided eye at a 20 foot distance in normal daylight conditions.
- E. Replace in manner that results in cast stone work matching approved samples and field-constructed mock-ups, complying with other requirements, and showing no evidence of replacement.

### **3.05 PROTECTION**

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and installer ensuring cast stone work being without damage or deterioration at time of Substantial Completion.

**END OF SECTION**



**SECTION 04 73 00**  
**MANUFACTURED STONE MASONRY**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Simulated Stone
    - a. Interior Use
    - b. Exterior Use
- B. Related Sections:
  - 1. Section 04 20 00 (04200) - Masonry Units
  - 2. Section 07 19 00 (07190) - Water Repellents
  - 3. Section 07 62 00 (07620) - Sheet Metal Flashing and Trim
  - 4. Section 07 92 00 (07920) - Joint Sealants
  - 5. Section 09 21 16 (09255) - Gypsum Board Assemblies
- C. Products installed, but not furnished, under this Section include the following:
  - 1. [Steel Lintels] [and] [Shelf Angles] for simulated stone masonry, furnished under Section 05 50 00 (05500), Metal Fabrications.
  - 2. Hollow-metal frames in simulated stone masonry openings, furnished under Section 08 11 13 (08110), Steel Doors and Frames.

**1.02 REFERENCES**

- A. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)
  - 1. C144 "Standard Specification for Aggregate for Masonry Mortar"
  - 2. C144 "Standard Specification for Aggregate for Masonry Mortar"
  - 3. C207 "Standard Specification for Hydrated Lime for Masonry Purposes; 1991 (Re-approved 1997)"

**1.03 DEFINITIONS**

- A. Simulated Stone: Architectural precast stone units intended to simulate natural stone.

**1.04 SYSTEM DESCRIPTION**

- A. General: Fabricate and install simulated stone to withstand loads from wind, gravity, movement of building structure, and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.
- B. Provide hand-set (field-installed) anchoring system, including connections to building structure, that is capable of sustaining forces generated by gravity loads, wind loads, and stresses induced by thermal movement, acting separately or in combination, within the following parameters:

**1.05 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data for each type of simulated stone, accessory, and other manufactured products, including certifications that each type complies with specified requirements.
- B. Samples for verification purposes of simulated stone in form of sets for each color, grade, finish, type, and variety of simulated stone required.
  - 1. Colored pointing mortar and grout samples for each color required showing full range of exposed color and texture to be expected in completed work.
- C. Shop Drawings detailing fabrication and installation of simulated stone cladding. Include setting Drawings indicating sizes, dimensions, sections, and profiles of stones, arrangement and provisions for jointing, supporting, anchoring, and bonding stonework, and details showing relationship with, attachment to, and reception of related work.
  - 1. Include building elevations showing layout of units and locations of joints and anchors.

- D. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A firm experienced in manufacturing simulated stone similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.
- B. Single-Source Responsibility for Simulated stone: Obtain each color, grade, finish, type, and variety of stone from a single manufacturer with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to mold and finish material without delaying the progress of the work.
- C. Single-Source Responsibility for Mortar and Grout Materials: Obtain mortar ingredients of uniform quality and from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- D. Single-Source Responsibility for Other Materials: Obtain each type of simulated stone accessory, sealant, and other materials from one manufacturer for each product.
- E. Installer Qualifications; Engage an experienced installer who has completed stone cladding similar in material, design, and extent to that indicated for project that has resulted in construction with a record of 5 years of successful in-service performance.
- F. Sample Panels: Before installing simulated stone, build sample panels, using materials indicated for the completed Work, to verify selection and to demonstrate aesthetic effects. Build sample panels for each type of exposed simulated stone assembly in sizes approximately 48 inches long by 48 inches high by full thickness.
  - 1. Locate panels in the locations indicated or, if not indicated, as directed by Owner's Representative.
  - 2. Build mock-ups for the following types of dimension stonework:
    - a. Typical exterior simulated stone of each type, full size in conjunction with mock-up for EIFS or face brick. Illustrate field pattern of stone and color and tooling of joints.
    - b. Mockups may be incorporated into the work. If not, retain mock-ups during construction as standard for judging completed dimensions stonework. When directed, demolish mock-ups and remove from site.
    - c. Clean exposed faces of panels with masonry cleaner indicated.
    - d. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
    - e. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by the Owner's Representative in writing.
      - 1) Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by the Owner's Representative in writing.
    - f. Demolish and remove sample panels when directed.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver simulated stone materials to project in undamaged condition in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store simulated stone on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
  - 1. Do not use pinch or wrecking bars.
  - 2. Lift with wide-belt-type slings where possible. Do not use wire rope or ropes containing tar or other substances that might cause staining. If required to move stone, use wood rollers with cushions at end of wood slides.

3. Store simulated stone on wood skids or pallets covered with nonstaining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones.
  4. Protect cast stored stone from weather with waterproof, nonstaining covers or enclosures, but allow air to circulate around stones.
  5. Store cementitious materials off the ground, under cover, and in dry location.
  6. Do not use salt or calcium-chloride to remove ice from simulated stone surfaces.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Store simulated stone accessories, including metal items, to prevent deterioration by corrosion and accumulation of dirt.

## **1.08 PROJECT/SITE CONDITIONS**

- A. Protection of Work: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed simulated stone when construction is not in progress.
- B. Staining: Prevent grout, mortar, and soil from staining the face of simulated stone to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such simulated stone.
1. Protect base of walls from rain-splashed mud and from mortar splatter by means of coverings spread on ground and over wall surface.
- C. Environmental Requirements:
1. Ambient air temperature shall be in accordance with manufacturer's requirements.
  2. Maintain materials and surrounding air temperature to minimum 40 degrees prior to, during, and for 48 hours after completion of work.
  3. Protect materials from rain, moisture, and freezing temperatures prior to, during, and after 48 hours after completion of work.
  4. Allow no construction activity on opposite side of wall during installation, and for 48 hours after completion of work.

## **PRODUCTS**

### **2.01 MATERIALS, GENERAL**

- A. Comply with referenced standards and other requirements indicated applicable to each type of material required.

### **2.02 MANUFACTURERS**

- A. Avendra, LLC Preferred Manufactures:
1. None
- B. Approved Manufacturers:
1. "Cultured Stone"; Cultured Stone, Division of Owens Corning (800-255-1727)
  2. "Eldorado Stone "; Eldorado Stone, A Headwaters Company (800-925-1491)
  3. Approved Substitution
    - a. Sizes and Shapes: As indicated in [Interior] [Exterior] Finish Index.
    - b. Color & Texture: As indicated in [Interior] [Exterior] Finish Index.
    - c. Approved Substitution.

### **2.03 ACCESSORIES**

- A. Flexible Flashing: As specified in Section 04 20 00.
- B. Metal Lath: 18 gauge galvanized woven wire mesh, or galvanized [2.5 lb. Flat diamond mesh] [3.4 lb. Flat Rib]
- C. Weather Resistant Barrier: Kraft waterproof building paper, UBC Standard 14-1.
- D. Water Repellant Coating:
1. As specified in Section 07 19 00.

2. "Craftshield"; Eldorado Stone, A Headwaters Company (800-925-1491)

## **2.04 MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C150, Type I, of natural color or white, as needed to produce color indicated.
- B. Hydrated Lime: ASTM C207, Type S
- C. Aggregate: ASTM C144, and as indicated below:
  1. For joints narrower than 1/4 inch, use aggregate graded with 100percent passing the No. 8 sieve and 95 percent the No. 16 sieve.
  2. For pointing mortar, use aggregate graded with 100 percent passing the No. 16 sieve.
  3. White Mortar Aggregates: Natural white sand or ground white stone.

## **2.05 SIMULATED STONE FABRICATION**

- A. General: Fabricate simulated stone in sizes and shapes required to comply with requirements indicated, including details on Drawings and final Shop Drawings.
- B. Carefully inspect finished stones at fabrication plant for compliance with requirements relative to qualities of appearance, material, and fabrication. Replace defective stones with ones that do comply.

## **2.06 MORTAR AND GROUT MIXES**

- A. General: Comply with referenced standards and with manufacturers' instructions relative to mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality and with optimum performance characteristics.
  1. Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or calcium chloride, unless otherwise indicated.
  2. Mixing: Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortars and grout when they have reached their initial set.
- B. Portland Cement/Lime Setting Mortar for Nonpaving Installations: Comply with ASTM C 270, Proportion Specification, for types of mortars and stone indicated below:
  1. Set stone with Type N mortar. Color as selected by Architect.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine surfaces to receive simulated stone work, and conditions under which materials will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of dimension stonework. Do not proceed with installation until unsatisfactory conditions have been corrected.
  1. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of simulated stone work.

### **3.02 PREPARATION**

- A. Advise installers of other work about specific requirements relating to placement of inserts, flashing reglets, metal anchors, and similar items to be used by stonework installer for anchoring, supporting, and flashing of dimension stonework. Furnish installers of other work with Drawings or templates showing locations of these items.
- B. Verify items provided by other sections of work are properly sized and located.
- C. Sheathed Surfaces: Install one layer of weather-resistant barrier with lap joints of 4-inches shingle fashion. Apply code approved metal lath, attach using galvanized nails a minimum of 6-inches on center vertically and 16 inches on center horizontally, which penetrate a minimum of 1-inch into studs. Wrap weather resistant barrier and metal lath a minimum of 16 inches around all outside and inside corners.

- D. Concrete and Masonry Surfaces, New, Clean and Untreated: Examine newly poured concrete closely to ensure that the finished surface contains no releasing agents (form oil). If it does contain form oil, etch surface with muriatic acid, rinse thoroughly and score with a wire brush, or use high-pressure water, or sandblasting to remove. Apply code approved metal lath to surfaces, attach using galvanized concrete nails a minimum of 6-inches on center vertically and 16 inches on center horizontally.

### 3.03 ERECTION

- A. Comply with manufacturer's product data, including product technical bulletins and installation instructions.
- B. General: Install/set all units and accessories accurately, using skilled, experienced personnel, according to approved shop and setting drawings.
1. Use stone-fitters to perform field-cutting with power saws, when required.
    - a. Cut masonry units with wet-saw.
- C. Clean stone surfaces before setting, using only water or mild cleaning compounds containing no caustic or abrasives. Clean cut units using a stiff fiber brush and clean water. Allow units to surface dry prior to placement.
- D. Provide chases, reveals, openings, and other spaces required to accommodate other work. Close up after other work is complete with simulated stone which matches stone already set.
- E. Mortar: Apply 3/4 inch of mortar to lath, covering a maximum of 10 square feet at one time. Press the units firmly into position in soft mortar bed, wiggle and apply slight pressure to unit to ensure firm bonding causing mortar to extrude slightly around edges of units.
1. For stones applied in hot or dry weather, the back of each piece shall be moistened with a fine spray of water or a wet brush to adequately prevent excessive absorption of moisture from the mortar. If being installed over concrete, masonry or scratch coat substrate, the substrate surface area should also be dampened before applying mortar.
  2. Applications should be protected from freezing, as mortar will not set up properly under such conditions. Do NOT use antifreeze compounds to lower the freezing point of mortar.
- F. Masonry Flashing: Extend flashing through veneer, turn up and bed into mortar joint of masonry, seal to concrete or seal into sheathing over steel stud framed back-up.
1. Lap end joints and seal watertight.
- G. Lintels: Install lintels as scheduled.
- H. Joints:
1. Mortar joints should not be over 1/2-inch to 3/4-inch in width. Set simulated stone accurately, in patterns and locations indicated, with uniform joints of dimensions indicated, and with edges and faces aligned according to established relationships and indicated tolerances.
  2. When installing "pre-fitted" stone textures, units should be fitted tight against each other with no allowance for mortar joints.
  3. Remove excess mortar; do not allow mortar to set up on face of units. Point, [rake] and tool joints before mortar have set.
- I. Movement Control Joints
1. Construct movement joints in locations noted on Drawings.
  2. Do not continue horizontal joint reinforcing across movement control joints.
  3. Form movement control joints by leaving head joints between stacked units void of mortar, ready for application of bond breaker and joint sealant.
  4. Size joint in accordance with Section 07 92 00 for sealant performance.
- J. Setting Units: Press each stone into the mortar setting bed firmly enough to squeeze some mortar out around the stone's edges. Apply pressure to the stone to ensure a good bond. Ensure complete coverage between the mortar bed and the surface of the stone. Mortar may also be applied to the entire back of the stone.
- K. Shim and adjust anchors, supports, and accessories.

- L. Mortar Color: As indicated in [Interior] [Exterior] Finish Index.

### **3.04 PROTECTION**

- A. Protect work during erection as follows:
1. Cover top of walls with nonstaining waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold securely in place.
  2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials from stone without damage to latter.
  3. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
  4. Protect sills, ledges, and projections from droppings of mortar and sealants.
- B. Provide final protection and maintain conditions in a manner acceptable to fabricator and installer ensuring dimension stonework being without damage or deterioration at time of Substantial Completion.

### **3.05 ADJUSTING AND CLEANING**

- A. General: Perform final cleaning as soon as possible after mortar has set and been tooled. Clean faces of stone at pointed joints immediately. Remove soiled areas, streaks and stains from prefinished panels using clean water and soft bristle brush, followed by clear water rinse.
- B. Use no wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods which could damage, discoloration, etching of surfaces or joints, without written approval from simulated stone manufacturer.
- C. Clean stone surfaces that have become dirty or stained prior to setting to remove soil, stains, and foreign materials. Clean stones by thoroughly scrubbing stones with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh filler or abrasives.
- D. Remove and replace or repair simulated stone work of the following description:
1. Broken, chipped, stained, or otherwise damaged stones. Broken, chipped, stained, or otherwise damaged stone may be repaired, providing the methods and results are acceptable to Architect.
  2. Defective joints.
  3. Stones and joints not matching approved samples and field-constructed mock-up.
  4. Simulated stone work not complying with other requirements indicated.
- E. Acceptable Appearance: Simulated stone shall show no obvious repairs or imperfections, other than minimal color variations, when viewed with the unaided eye at a 20 foot distance in normal daylight conditions.
- F. Replace in manner that results in dimension stonework matching approved samples and field-constructed mock-ups, complying with other requirements, and showing no evidence of replacement.
- G. Remove protection materials upon substantial performance of the work or when risk of damage is no longer present.

### **END OF SECTION**

**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Structural Steel
- B. Related Sections:
  - 1. Section 01 45 00 - Quality Control
  - 2. Section 03 30 00 - Cast-in-Place Concrete
  - 3. Section 05 21 00 - Steel Joist Framing
  - 4. Section 05 31 00 - Steel Decking
  - 5. Section 05 40 00 - Cold-Formed Metal Framing
  - 6. Section 05 50 00 - Metal Fabrications
  - 7. Section 09 90 00 - Painting
  - 8. Section 09 96 00 - High Performance Coatings

**1.02 DEFINITIONS**

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.
- B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.
- C. Construction: Type [PR, partially] [FR, fully] restrained.
- D. Construction: Type [1, rigid frame] [2, simple framing] [3, semirigid framing].

**1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Shop Drawings detailing fabrication of structural steel components.
    - a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
    - b. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
    - c. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
    - d. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.
  - 2. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
  - 3. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
    - a. Structural steel, including chemical and physical properties
    - b. Bolts, nuts, and washers, including mechanical properties and chemical analysis
    - c. Direct-tension indicators
    - d. Shear stud connectors
    - e. Shop primers

- f. Nonshrink grout

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer with a minimum of five years experience, who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
  - 1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
    - a. Category: Category "Cbd", Complex Steel Building Structures.
    - b. Category: Category "Sbd", Conventional Steel Building Structures.
    - c. Fabricator shall be registered with and approved by authorities having jurisdiction.
- C. Comply with applicable provisions of the following specifications and documents:
  - 1. American Institute of Steel Construction Inc. (AISC) Publications:
    - a. "AISC Code of Standard Practice for Steel Buildings and Bridges."
    - b. "Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design."
    - c. "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
    - d. "Specification for Allowable Stress Design of Single-Angle Members."
    - e. "Load and Resistance Factor Design Specification for Single-Angle Members."
    - f. "Seismic Provisions for Structural Steel Buildings."
  - 2. ASTM International Publications:
    - a. A6 "Standard Specification for General Requirements for Rolled Steel Bars, Plates, Shapes, and Sheet Piling."
    - b. A27 "Standard Specification for Steel Castings, Carbon, for General Application"
    - c. A36 "Standard Specification for Carbon Structural Steel".
    - d. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
    - e. A108 "Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished"
    - f. A123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"
    - g. A148 "Standard Specification for Steel Castings, High Strength, for Structural Purposes"
    - h. A153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
    - i. A325 "Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength"
    - j. A490 "Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength"
    - k. A500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes"
    - l. A501 "Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing"
    - m. A572 "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel"
    - n. A588 "Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4-in. [100-mm] Thick"
    - o. A780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings"
    - p. B695 "Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel"
    - q. C1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)"



- r. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
- s. E164 "Standard Practice for Ultrasonic Contact Examination of Weldments"
- t. E709 "Standard Guide for Magnetic Particle Examination"
- u. F959 "Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners"
- 3. Research Council on Structural Connections (RCSC) Publications:
  - a. "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  - b. "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.
- E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."
  - 1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Section 01 31 00 "Project Management and Coordination."

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
  - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

## **1.07 SEQUENCING**

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

## **PRODUCTS**

### **2.01 MATERIALS**

- A. Structural Steel Shapes, Plates, and Bars: As follows:
  - 1. Carbon Steel: ASTM A36.
  - 2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A572, Grade 50.
  - 3. High-Strength, Low-Alloy Structural Steel: ASTM A588, Grade 50, corrosion resistant.
- B. Cold-Formed Structural Steel Tubing: ASTM A500, Grade B.
- C. Hot-Formed Structural Steel Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53, Type E or S, Grade B.
  - 1. Finish: Black, except where indicated to be galvanized.
  - 2. Carbon-Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.
- E. High-Strength Steel Castings: ASTM A148, Grade 80-50.
- F. Shear Connectors: ASTM A108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.
- G. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A36.
  2. Headed Bolts: ASTM A325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
  3. Headed Bolts: ASTM A490, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
  4. Washers: ASTM A36.
- H. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers. Finish shall match material connected unless noted otherwise on plans.
1. Finish: Plain, uncoated.
  2. Finish: Hot-dip zinc-coating, ASTM A153, Class C.
  3. Finish: Mechanically deposited zinc-coating, ASTM B695, Class 50.
  4. Direct-Tension Indicators: ASTM F959, Type 325.
    - a. Finish: Plain, uncoated.
    - b. Finish: Mechanically deposited zinc-coating, ASTM B695, Class 50.
    - c. Finish: Mechanically deposited zinc-coating, ASTM B695, Class 50, epoxy coated.
- I. High-Strength Bolts, Nuts, and Washers: ASTM A490, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.
1. Direct-Tension Indicators: ASTM F959, Type 490, uncoated.
- J. Welding Electrodes: Comply with AWS requirements.

## 2.02 PRIMER

- A. Fabricator's standard, fast-curing, lead-free, universal primer; selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, complying with performance requirements of FS TT-P-664.
1. Primer paint shall be compatible with finish coats on architecturally exposed steel.
    - a. SSPC Paint 25 BCS, Type II, iron oxide, zinc oxide, raw linseed oil and Alkyd or one coat of SSPC Paint 23, latex primer, as verified with top coat manufacturer.
- B. Where prime painted steel is to receive sprayed-on fireproofing, the substrate shall provide adequate adhesion. Coordinate with fireproofing installer in selecting primer paint to be used to assure this requirement is met.

## 2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time.

## 2.04 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
1. Camber structural steel members where indicated.
  2. Identify high-strength structural steel according to ASTM A6 and maintain markings until steel has been erected.
  3. Mark and match-mark materials for field assembly.
  4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
  5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
  6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

- B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
  - 1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
  - 2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded.
- D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.
- F. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.
- G. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
  - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
  - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

## 2.05 SHOP CONNECTIONS

- A. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  - 1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
  - 2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
  - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

## 2.06 PREFABRICATED BUILDING COLUMNS

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Black Rock Column, Inc. (800-270-5882)
  - 2. Dean Lally L.P./Fire-Trol Columns (800-323-5514)
  - 3. Approved substitution
- C. Definition: Prefabricated building columns consist of assemblies composed of load-bearing structural steel members encased in manufacturer's standard insulating material for fire protection and wrapped in outer nonload-bearing steel sheet enclosures.

- D. Fire-Test-Response Characteristics: Provide prefabricated building column assemblies identical to those of assemblies tested for the following fire-resistance ratings per ASTM E119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify columns with appropriate markings of applicable testing and inspecting agency.
  - 1. Fire-Resistance Rating: As indicated.
- E. Column Configuration: Provide columns of sizes and shapes indicated. Fabricate connections to comply with details shown or required to suit type of structure indicated.
  - 1. Concrete Fill: Structural concrete, manufacturer's standard mix, with a minimum 28-day compressive strength of 5,000 psi, machine mixed and mechanically vibrated during placement to produce a concrete core free of voids.
- F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering prefabricated building columns that may be incorporated in the Work include, but are not limited to, the following:

## **2.07 SHOP PRIMING**

- A. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections.
  - 4. Surfaces to receive sprayed-on fireproofing.
  - 5. Exterior Railings and surfaces within interior pool area to receive "high performance coatings" require special primers. See Section 09 06 00.
  - 6. Galvanized surfaces.
- B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Society for Protective Coatings (SSPC) Surface Preparation Guidelines as follows:
  - 1. All interior steel exposed to view: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
  - 2. All exterior steel exposed to weather: SSPC-SP 10/NACE No. 2, Near White Blast Cleaning.
  - 3. All other steel: SSPC-SP 3, Power Tool Cleaning.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
- D. Paint Systems: Review painting specifications for finish paint systems. Coordinate surface preparations of steel and type of primer used with specifications and the manufacturer's recommendations to insure compatibility.

## **2.08 GALVANIZING**

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A123.

## **2.09 SOURCE QUALITY CONTROL**

- A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
  - 1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
  - 2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Joints Using ASTM A325 or A490 Bolts."
- E. Shop-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  - 1. Direct-tension indicator gaps will be verified to comply with ASTM F959, Table 2.
- F. In addition to visual inspection of all welds, shop-welded full penetration welds will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
  - 1. Liquid Penetrant Inspection: ASTM E165.
  - 2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - 3. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."
  - 4. Ultrasonic Inspection: ASTM E164.
- G. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
  - 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

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

### **3.03 ERECTION**

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
  - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
  - 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
    - a. Comply with manufacturer's instructions for proprietary grout materials.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  - 1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by Engineer of Record.
- H. Finish sections thermally cut during erection equal to a sheared appearance.
- I. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

### **3.04 FIELD CONNECTIONS**

- A. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  - 1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
  - 2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
  - 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
  - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

### **3.05 PREFABRICATED BUILDING COLUMNS**

- A. Install prefabricated building columns to comply with AISC specifications referenced in this Section, manufacturer's recommendations, and requirements of the testing and inspecting agency that apply to the fire-resistance rating indicated.

### **3.06 FIELD QUALITY CONTROL**

- A. [Owner will engage an independent testing and inspecting agency] [Contractor shall engage an independent testing and inspecting agency acceptable to Owner [and Architect]] to perform field inspections and tests and to prepare test reports.
  - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  - 1. Direct-tension indicator gaps will be verified to comply with ASTM F959, Table 2.

- E. In addition to visual inspection of all welds, field-welded full penetration welds will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
  - 1. Liquid Penetrant Inspection: ASTM E165.
  - 2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - 3. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."
  - 4. Ultrasonic Inspection: ASTM E164.
- F. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
  - 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

### **3.07 CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
  - 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Section 09 90 00 "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A780.

**END OF SECTION**

**SECTION 05 31 00**  
**STEEL DECKING**

**GENERAL**

**1.01 SUMMARY**

- A. Section includes:
  - 1. Roof Deck
  - 2. Composite Floor Deck
  - 3. Noncomposite Form Deck
- B. Related Sections:
  - 1. Section 01 45 00 - Quality Control
  - 2. Section 05 21 00 - Steel Joist Framing
  - 3. Section 05 40 00 - Cold-Formed Metal Framing
  - 4. Section 05 50 00 - Metal Fabrications
  - 5. Section 09 90 00 - Painting
  - 6. Section 09 96 00 - High Performance Coatings

**1.02 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.
  - 2. Welding Certificates: Copies of certificates for welding procedures and personnel.
  - 3. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
    - a. Mechanical fasteners.
    - b. Acoustical roof deck.
  - 4. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

**1.03 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer with a minimum of five years of experience who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 to conduct the testing indicated, as documented according to ASTM E548.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel," and AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E119 by a testing and inspection agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
  - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.



- E. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."
- F. FMG Listing: Provide steel roof deck evaluated by FMG and listed in FMG's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.
- G. Comply with applicable provisions of the following specifications and documents:
  - 1. American Iron and Steel Institute (AISI) Publications:
    - a. Calculate structural characteristics of steel deck according to:
    - b. SG02 "North American Specification for the Design of Cold-Formed Steel Structural Members".
  - 2. ASTM International Publications:
    - a. A108 "Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished"
    - b. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
    - c. A780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings"
    - d. A1008 "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
    - e. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
    - f. E329 "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction"
  - 3. American Welding Society (AWS) Publications:
    - a. D1.1 "Structural Welding Code - Steel"
    - b. D1.3 "Structural Welding Code - Sheet Steel"
  - 4. Steel Deck Institute (SDI) Publications:
    - a. No. 30 "Design Manual for Composite Decks, Form Decks and Roof Decks"

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

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

### **PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Avendra, LLC Preferred Manufacturers.
  - 1. None
- B. Approved Manufacturers:
  - 1. Steel Deck:
    - a. Consolidated Systems, Inc. (CSi) Metal Dek Group (800-654-1912)
    - b. Epic Metals Corporation (877-696-3742)
    - c. Nucor, Vulcraft Group (843-662-0381)
    - d. Roof Deck, Inc. (800-631-0057)
    - e. United Steel Deck, Inc., a subsidiary of Bouras Industries Inc. (800-631-1215)
    - f. Verco Manufacturing Co. (602-272-1347)
    - g. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp. (877-333-0900)
    - h. Infinity Structures Inc. (678-513-4080)
    - i. Approved substitution.

#### **2.02 ROOF DECK**

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply the Steel Deck Institute's "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 29, and the following:

1. Prime-Painted Steel Sheet: ASTM A1008, Structural Steel (SS), Grade [40] minimum, shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
2. Galvanized and Shop-Primed Steel Sheet: ASTM A653, Structural Steel (SS), Grade [40], G60 (Z180) zinc coating; cleaned, pretreated, and shop primed with gray or white baked-on, rust-inhibitive primer.
3. Deck Profile, Gauge and Depth: [As noted on structural drawings].

## **2.03 COMPOSITE FLOOR DECK**

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with the Steel Deck Institute's "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, the minimum section properties indicated, and the following:

## **2.04 SELECT EITHER PRIME-PAINTED STEEL OR GALVANIZED AND SHOP PRIMED STEEL SHEET. DELETE SUBPARAGRAPH NOT USED. VERIFY GRADE SELECTION IN EXAMPLE BELOW WITH STRUCTURAL ENGINEER.**

- A. Galvanized Steel Sheet: ASTM A653, Structural Steel (SS), Grade 33, G60 zinc coating.
- B. Prime-Painted Steel Sheet: ASTM A1008. Structural Steel (SS), Grade [40] minimum, with top surface phosphatized and unpainted and bottom surface shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
- C. Profile Depth and Gauge: [As noted on Drawings].

## **2.05 NONCOMPOSITE FORM DECK**

- A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, the minimum section properties indicated, and the following:
  1. Uncoated Steel Sheet: ASTM A1008. Structural Steel (SS), Grade [40] minimum.
  2. Galvanized Steel Sheet: ASTM A1008. Structural Steel (SS), Grade [40] G60 zinc coating.
  3. Prime-Painted Steel Sheet: ASTM A1008. Structural Steel (SS), Grade [40] minimum, bottom surface shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
  4. Profile Depth and Gauge: [As noted on Drawings].

## **2.06 ACCESSORIES**

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Rib Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile [indicated] [recommended by SDI Publication No. 30 for overhang and slab depth].
- H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

- I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch] [0.0747 inch] thick, with factory-punched hole of 3/8-inch minimum diameter.
- K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and [level] [sloped] recessed pans of 1-1/2- inch minimum depth. For drains, cut holes in the field.
- L. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- M. Shear Connectors: ASTM A108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- N. Galvanizing Repair Paint: SSPC -Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- O. Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

### **3.02 INSTALLATION - GENERAL**

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate decking bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
  - 1. Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

### **3.03 INSTALLATION - ROOF DECK**

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long, spaced [as indicated on the Drawings]:
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals shown on the structural drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints lapped 2" minimum.

- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld at each corner.
- E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### **3.04 INSTALLATION - FLOOR DECK**

- A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter and spacing [as indicated on the Drawings].
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, [as indicated on the Drawings].
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches with end joints butted.
- D. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arc shields after welding shear connectors.
- E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- F. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.
- G. Install piercing hanger tabs not more than 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

### **3.05 FIELD QUALITY CONTROL**

- A. [Owner will engage an independent testing and inspecting agency] [Contractor shall engage an independent testing and inspecting agency acceptable to Owner [and Architect]] to perform field inspections and tests and to prepare test reports.
- B. Field welds will be subject to inspection.
- C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:
  - 1. Shear connector stud welds will be visually inspected.
  - 2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
  - 3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.
- D. Testing agency will report test results promptly and in writing to Contractor and [Owner's Representative] [Architect].
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### **3.06 REPAIRS AND PROTECTION**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas of prime-painted deck immediately after installation, and apply repair paint.
  - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
  - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09 Section.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

**SECTION 05 40 00**  
**COLD-FORMED METAL FRAMING**

**GENERAL**

**1.01 SUMMARY**

- A. Section includes:
  - 1. Exterior Load-Bearing Wall Framing
  - 2. Interior Load-Bearing Wall Framing
  - 3. Exterior Non-Load-Bearing Curtain-Wall Framing
  - 4. Floor Joist Framing
  - 5. Roof Trusses
  - 6. Roof Rafter Framing
  - 7. Ceiling Joist Framing
- B. Related Sections:
  - 1. Section 05 50 00 (05500) - Metal Fabrications:
  - 2. Section 06 10 00 (06100) - Rough Carpentry:
  - 3. Section 09 21 16 (09255) - Gypsum Board Assemblies:
    - a. For interior non-load-bearing metal-stud framing and ceiling-suspension assemblies.
  - 4. Section 09 21 16.23 (09265) - Gypsum Board Shaft-Wall Assemblies

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. A153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
  - 2. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  - 3. A780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings"
  - 4. A1003 "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members"
  - 5. A1011 "Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
  - 6. B633 "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel"
  - 7. B695 "Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel"
  - 8. C150 "Standard Specification for Portland Cement"
  - 9. C404 "Standard Specification for Aggregates for Masonry Grout"
  - 10. C955 "Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases"
  - 11. C1007 "Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories"
  - 12. C1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)"
  - 13. C1513 "Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections"
  - 14. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
  - 15. E329 "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction"
  - 16. E488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"
  - 17. F1554 "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength"
- B. American Iron and Steel Institute (AISI) Publications:
  - 1. "North American Standard for the Design of Cold-Formed Steel Structural Members"
  - 2. "North American Standard for Cold-Formed Steel Framing - Truss Design"
  - 3. S2002 "Code of Standard Practice for Cold-Formed Steel Structural Framing"
- C. American Institute of Steel Construction Inc. (AISC) Publications:

1. "Standard Definitions for Use in the Design of Steel Structures"
2. S100 "Specification for Structural Steel Buildings"
- D. American Welding Society (AWS) Publications:
  1. D1.1 "Structural Welding Code - Steel"
  2. D1.3 "Structural Welding Code - Sheet Steel"
- E. Federal Specifications (FS) Publications:
  1. DOD-P-21035A (formerly MIL-P-21035), Galvanizing Repair Specification
- F. Gypsum Association (GA) Publications:
  1. GA-600 "Fire Resistance Design Manual"
- G. The Society for Protective Coatings (SSPC) Publications:
  1. Paint - Paint and Coating Standards and Specifications
    - a. Paint 20 "Zinc-Rich Coating, Type I - Inorganic and Type II - Organic"
- H. Underwriter's Laboratories, Inc. (UL) Standards:
  1. UL's "Fire Resistance Directory"

### 1.03 DEFINITIONS

- A. Definition below is based on description of delivered minimum thickness in AISC's "Standard Definitions for Use in the Design of Steel Structures."
  1. Cold-Formed Steel Structural Member. Shape manufactured by press-braking blanks sheared from sheets, cut lengths of coils or plates, or by roll forming cold- or hot-rolled coils or sheets; both forming operations being performed at ambient room temperature, that is, without manifest addition of heat such as would be required for hot forming.

### 1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated on Drawings.
  1. Comply with AISC's "North American Standard for the Design of Cold-Formed Steel Structural Members."
  2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Wall Framing: Horizontal deflection of 1/360 of the wall height and 1/720 for studs backing masonry veneer.
    - b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.
    - c. Floor Joist Framing: Vertical deflection of 1/480 of the span.
    - d. Roof Trusses: Vertical deflection of 1/240 of the span.
    - e. Scissor Roof Trusses: Horizontal deflection of 1-1/4 inches at reactions.
    - f. Roof Rafter Framing: Horizontal deflection of 1/240 of the horizontally projected span.
    - g. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.
  3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
  4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate typical live load deflections of primary building structure unless noted otherwise on the drawings.
  5. Design exterior non-load-bearing curtain-wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- B. Design roof trusses according to AISI's "North American Standard for Cold-Formed Steel Framing - Truss Design"

### 1.05 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
1. Mill certificates test reports from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
  2. Welding Certificates: Copies of certificates for welding procedures and personnel.
  3. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
  4. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
    - a. Edit list and add other test reports if required. Delete paragraph above and subparagraphs below if not required.
    - b. Expansion anchors
    - c. Power-actuated anchors
    - d. Mechanical fasteners
    - e. Vertical deflection clips
    - f. Miscellaneous structural clips and accessories
  5. Research/Evaluation Reports: Metal stud manufacturer to have a 3rd party evaluation report for its products that are reviewed to the local building code or its model code [IBC 2009 and AISC S100] [IBC 2012 and AISC S100].
- C. Shop Drawings:
1. Submit shop drawings prepared by the cold-formed metal framing manufacturer showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.
  2. Show connection details with screw types and locations, weld lengths and locations, and other fastener requirements.
  3. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Analysis shall contain the following:
    - a. Description of design criteria.
    - b. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application.
    - c. Selection of framing components, accessories and welded connection requirements.
    - d. Verification of attachments to structure and adjacent framing components.

## **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer with a minimum of five years of experience, who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- D. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.
- E. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 to conduct the testing indicated.



- F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- G. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance Ratings: Indicated by the Gypsum Association GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
- H. AISI Specifications: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members".
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section 01 31 00 (01310) "Project Management and Coordination."

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required in AISI's "Code of Standard Practice for Cold-Formed Steel Structural Framing".
- B. Store materials protected from exposure to rain, snow or other harmful weather conditions, at temperature and humidity conditions per the recommendations of ASTM C955 as required in AISI's "Code of Standard Practice for Cold-Formed Steel Structural Framing".

## **PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. ClarkDietrich Building Systems LLC (513-870-1100)
  - 2. Marino; Div. of Ware Industries, Inc. (800-627-4661)
  - 3. Super Stud Building Products, Inc. (718-545-5700)
  - 4. Approved substitution

### **2.02 MATERIALS**

- A. Steel Sheet: ASTM A1003, Structural Grade, Type H, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: [ST33H] [ST50H].
  - 2. Coating: Minimum G60 coating weight complying with ASTM C955.
- B. Steel Sheet for [Vertical Deflection] [Drift] Clips: ASTM A1003, A653, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: [50] [340].
  - 2. Coating: Minimum G90 coating weight complying with ASTM Z275.

### **2.03 LOAD-BEARING WALL FRAMING**

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-5/8 inches minimum
  - 3. Section Properties: As indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-1/4 inches minimum.
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement,

with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Minimum Uncoated-Steel Thickness: As indicated on Drawings.
  2. Flange Width: A minimum of 2 inches
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
    - a. Minimum Uncoated-Steel Thickness: As indicated on Drawings.
    - b. Flange Width: A minimum of 2 inches.
  2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Uncoated-Steel Thickness: As indicated on Drawings.
    - b. Flange Width: A minimum flange width of 3-1/2 inches.
- E. Vertical Deflection Clips: Manufacturer's standard bypass or head clips as indicated on Drawings, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- F. Headers and Jambs
1. Approved Manufacturers:
    - a. ["Heavy Duty Stud (HDS)"] [and] ["Header Bracket (HDSC)"]; ClarkDietrich Building Systems LLC
    - b. Approved Substitution by listed manufacturers.
  2. Heavy-Duty Stud: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges and as follows:
    - a. Minimum Base-Metal Thickness: [0.0329 inch] [0.0428 inch] [0.0538 inch] [0.0677 inch] [0.0966 inch] [Matching steel studs].
    - b. Web and Flange Widths, Type HDS: [3-5/8 by 3 by 1-1/16 by 3/4 inch ] [6 by 3 by 2-1/4 by 3/4 inch ].
    - c. Web and Flange Widths, Type HDSC: [3-1/2 by 3-1/16 by 2 inches ] [5-7/8 by 3-1/16 by 2 inches ].
- G. Opening Framing:
1. Product: ClarkDietrich Building Systems; RedHeader RO System.
  2. Allow for alternative valued engineered opening framing systems (RedHeader RO System) manufactured by ClarkDietrich Building Systems.
  3. Minimum Material Thickness: As required by design.
  4. Minimum Flange Width: As required by design.

## **2.04 NON-LOAD-BEARING CURTAIN-WALL FRAMING**

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C955, and as follows:
1. Minimum Uncoated-Steel Thickness: As indicated.
  2. Flange Width: 1-3/8 inches minimum.
  3. Section Properties: As indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C955, and as follows:
1. Minimum Uncoated-Steel Thickness: As indicated.
  2. Flange Width: 1-1/4 inches minimum.
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:
1. Minimum Uncoated-Steel Thickness: As indicated.
  2. Flange Width: A minimum of 2 inches

- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
  - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads, and as follows:
    - a. Minimum Uncoated-Steel Thickness: As indicated.
    - b. Flange Width: A minimum of 2 inches.
  - 2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Uncoated-Steel Thickness: As indicated.
    - b. Flange Width: A minimum flange width of 3-1/2 inches.
- E. Slotted Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure, as follows:
  - 1. Approved Manufacturers:
    - a. ["BlazeFrame DSL"] ["MaxTrak"] Slotted Deflection Track; ClarkDietrich Building Systems LLC
    - b. Approved Substitution by listed manufacturers.
- F. Vertical Deflection Clips: Manufacturer's standard bypass or head clips as indicated on drawings, capable of accommodating upward and downward vertical displacement of primary structure.
- G. Bridging and Spacer Bar:
  - 1. Approved Manufacturers:
    - a. ["TradeReady Spazzer 5400 (SPZS)"] ["Spazzer Bar Guard (SPBG)"] ClarkDietrich Building Systems LLC
    - b. Approved Substitution by listed manufacturers.
  - 2. Minimum Base-Metal Thickness: 0.0538 inch.
  - 3. Size: 1-1/4 by 1-1/4 by 50 inches long, pre-notched at 12, 16, and 24 inches centers.

## **2.05 FLOOR JOIST FRAMING**

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-5/8 inches minimum.
  - 3. Section Properties: As indicated.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-5/8 inches minimum.

## **2.06 ROOF TRUSSES**

- A. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-5/8 inches minimum.
  - 3. Section Properties: As indicated.

## **2.07 ROOF-RAFTER FRAMING**

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-5/8 inches minimum.
  - 3. Section Properties: As indicated.

- B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated; complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-5/8 inches minimum.

## **2.08 CEILING JOIST FRAMING**

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, complying with ASTM C955, and as follows:
  - 1. Minimum Uncoated-Steel Thickness: As indicated.
  - 2. Flange Width: 1-5/8 inches minimum.
  - 3. Section Properties: As indicated.

## **2.09 FRAMING ACCESSORIES**

- A. Fabricate steel-framing accessories of the same material, coating and finish used for framing members per ASTM A1003, Structural Grade, Type H.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. End clips.
  - 5. Foundation clips.
  - 6. Gusset plates.
  - 7. Stud kickers, knee braces, and girts.
  - 8. Joist hangers and end closures.
  - 9. Hole reinforcing plates.
  - 10. Backer plates.

## **2.10 ANCHORS, CLIPS, AND FASTENERS**

- A. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153, Class C or mechanically deposition according to ASTM B695, Class 50.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

## **2.11 MISCELLANEOUS MATERIALS**

- A. Galvanizing Repair Paint: SSPC Paint 20 or DOD-P-21035 and ASTM A780.
- B. Cement Grout: Portland cement, ASTM C150, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and 30-minute working time.

## 2.12 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members squarely by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Welding is permitted on 18 gauge or heavier metal only. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
  - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Spacing: 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.
  - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

## EXECUTION

### 3.01 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

### 3.03 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C1007, unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
- E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and 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.

### **3.04 LOAD-BEARING WALL INSTALLATION**

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings indicated.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
  - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings.
  - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced 36 inches apart. Fasten at each stud intersection.
  1. Bridging: Cold-formed steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle.
  2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### **3.05 NON-LOAD-BEARING CURTAIN-WALL INSTALLATION**

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  1. Install single or double deep-leg deflection tracks and anchor to building structure.
  2. Connect vertical deflection clips to bypassing or infill studs and anchor to primary building structure.
- E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches apart. Fasten at each stud intersection.
  1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
    - a. Install solid blocking at centers indicated.
  2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

### **3.06 JOIST INSTALLATION**

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
  1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
  2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists as indicated and not more than 2 inches from abutting walls.

- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated.
  - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at each end of joists and at intervals indicated. Fasten bridging at each joist intersection as follows:
  - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

### **3.07 TRUSS INSTALLATION**

- A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.
- B. Truss Spacing: As indicated.
- C. Do not alter, cut, or remove framing members or connections of trusses.
- D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.
- E. Erect trusses without damaging framing members or connections.
- F. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.
- G. Install continuous bridging and permanently brace trusses as indicated [on Shop Drawings].

### **3.08 FIELD QUALITY CONTROL**

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

### **3.09 REPAIRS AND PROTECTION**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

### **END OF SECTION**



**SECTION 05 50 00**  
**METAL FABRICATIONS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Rough Hardware
  - 2. Loose Bearing and Leveling Plates
  - 3. Loose Steel Lintels
  - 4. Metal Stairs
  - 5. Ladders:
    - a. Elevator Pit Ladder
    - b. Roof Ladder
  - 6. Support Angles for Elevator Door Sills
  - 7. Elevator Sump Pit Cover
  - 8. Pipe Bollards
  - 9. Laundry Trench Grate
  - 10. Miscellaneous Metal Trim
  - 11. Steel Framing and Supports for Applications where framing and supports are not specified in other Sections
  - 12. Stair Nosings for Exterior Concrete Stairs
  - 13. Aluminum Roof Shade Canopy:
- B. Related Sections:
  - 1. Section 09 90 00 (09900) - Painting
  - 2. Section 09 96 00 (09960) - High Performance Coatings
  - 3. Section 10 82 13 - Exterior Grilles and Screens
  - 4. Section 14 24 13 (14240) - Hydraulic Elevators
  - 5. Section 32 31 13 (02821) - Fences and Gates

**1.02 REFERENCES**

- A. American Architectural Manufacturers Association (AAMA) Publications:
  - 1. 2605 "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels"
- B. ASTM International Publications:
  - 1. A27 "Standard Specification for Steel Castings, Carbon, for General Application"
  - 2. A36 "Standard Specification for Carbon Structural Steel".
  - 3. A47 "Standard Specification for Ferritic Malleable Iron Castings"
  - 4. A48 "Standard Specification for Gray Iron Castings"
  - 5. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
  - 6. A123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"
  - 7. A153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
  - 8. A307 "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength"
  - 9. A563 "Standard Specification for Carbon and Alloy Steel Nuts"
  - 10. A615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"
  - 11. A780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings"
  - 12. B429 "Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube"
  - 13. B633 "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel"
  - 14. C1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)"
  - 15. E488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"

16. F593 "Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs"
  17. F594 "Standard Specification for Stainless Steel Nuts"
  18. F1554 "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength"
- C. Federal Specifications (FS) Publications:
1. FS B 588 "Bolt, Toggle: And Expansion Sleeve, Screw" (Cancelled)
  2. FS FF S 325
  3. FS FF BS75
  4. FS TT P664 - Paint 25 (superceeds FS TT-P-664), Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel"
  5. DOD-P-21035A (formerly MIL-P-21035), Galvanizing Repair Specification
- D. The American Society of Mechanical Engineers (ASME) Publications:
1. A17.1 "Handbook on Safety Code for Elevators and Escalators"
  2. B18.2.1 "Square and Hex Bolts and Screws, Inch Series"
  3. B18.6.1 "Wood Screws (Inch Series)"
  4. B18.6.3 "Machine Screws and Machine Screw Nuts"
  5. B18.21.1 "Lock Washers (Inch Series)"
  6. B18.22.1 "Plain Washers"
- E. American Welding Society (AWS) Publications:
1. D1.1 "Structural Welding Code - Steel"
  2. D1.2 "Structural Welding Code--Aluminum"
  3. D1.3 "Structural Welding Code - Sheet Steel"
- F. National Association of Architectural Metal Manufacturers (NAAMM) Publications:
1. "Metal Finishes Manual"
  2. "Metal Stairs Manual"
- G. The Society for Protective Coatings (SSPC) Publications:
1. SP - Surface Preparation Standards and Specifications
    - a. SP 3 "Power Tool Cleaning"
    - b. SP 6/NACE No. 3, "Commercial Blast Cleaning"
  2. PA - Paint Application Standards, Guides, and Specifications
    - a. PA 1 "Shop, Field, and Maintenance Painting of Steel"
  3. Paint - Paint and Coating Standards and Specifications
    - a. Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film)
    - b. Paint 20 "Zinc-Rich Coating, Type I - Inorganic and Type II - Organic"
    - c. Paint 25 (superceeds FS TT-P-664), Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel"

### 1.03 SYSTEM DESCRIPTION

- A. System Performance Requirements:
1. All stairways, platforms, treads, and landings of Steel Stairs: Capable of supporting a live load of [100 lbf] per sf and a concentrated load of [300 lbf].
  2. Ladders: Comply with ANSI A14.3.

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
1. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project.
    - a. Include supporting product data for products used in miscellaneous metal fabrications, including paint products and grout.
- B. Submit Shop Drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

- C. Submit samples representative of materials and finished products as may be requested by Owner's Representative.

#### **1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Installer Qualifications: Arrange for installation of metal fabrications specified in this Section by same firm that fabricated them.
- C. Quality welding processes and welding operators in accordance with the following:
  - 1. AWS D1.1 "Structural Welding Code - Steel"
  - 2. AWS D1.3 "Structural Welding Code - Sheet Steel"
  - 3. AWS D1.2 "Structural Welding Code - Aluminum"
- D. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- E. Aluminum Roof Shade Canopy:
  - 1. General: Aluminum-framed Roof Shade Canopy shall withstand the effects of the following without failure due to defective manufacture, fabrication, installation, or other defects in construction:
    - a. Structural loads.
    - b. Thermal movements.
    - c. Movements of supporting structure.
    - d. Loosening or weakening of fasteners, attachments, and other components.

#### **1.06 PROJECT/SITE CONDITIONS**

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

#### **1.07 COORDINATION**

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

### **PRODUCTS**

#### **2.01 FERROUS METALS**

- A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes, and Bars: ASTM A36
- C. Steel Tubing: Cold-formed steel tubing complying with ASTM A500.
- D. Steel Pipe: ASTM A53
  - 1. Black finish, unless otherwise indicated.
  - 2. Galvanized finish for exterior installations, unless shown to receive special coatings.
  - 3. Type E, OR S, Grade B, Fy = 35 KSI, unless otherwise indicated, or another weight, type, and grade required by structural loads.
- E. Gray Iron Castings: ASTM A48, Class 30
- F. Malleable Iron Castings: ASTM A47, Grade 32510

- G. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- H. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A153.
- I. Welding Rods: Select in accordance with AWS Specifications for the metal alloy to be welded.

## **2.02 NONFERROUS METALS**

- A. Aluminum Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B221/B221M, Alloy 6063-T6.
- C. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- D. Aluminum Extruded Structural Pipe and Tubes: ASTM B429/B429M, alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

## **2.03 FASTENERS**

- A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required for each application and complying with applicable standards.
  - 1. Bolts and Nuts: Regular hexagon head bolts, ASTM A307, Grade A with hex nuts ASTM A563; and, where indicated, flat washers.
  - 2. Anchor Bolts: ASTM F1554, Grade 30
  - 3. Lag Bolts: Square head type, ASME B18.2.1
  - 4. Machine Screws: Cadmium plated steel, ASME B18.6.3
  - 5. Wood Screws: Flat head carbon steel, ASME B18.6.1
  - 6. Plain Washers: Round, carbon steel, ASME B18.22.1
  - 7. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1
  - 8. Drilled-in Expansion Anchors: Expansion Anchors Complying with FS FF S 325, Group VIII (anchors, expansion), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF BS75, Grade 5.
  - 9. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
    - a. Interior Use - Material: Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
    - b. Exterior and Swimming Pool Use - Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F593 and nuts complying with ASTM F594.
  - 10. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

## **2.04 GROUT AND ANCHORING CEMENT**

- A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior heavy-duty loading applications of type specified in this Section.
- B. Preferred Manufacturers:
  - 1. None
- C. Approved Manufacturers:
  - 1. "Euco N-S Grout", Euclid Chemical Co, An RPM Company (800-321-7628)
  - 2. "Masterflow 713 Plus ", Degussa Building Systems, Inc (800-243-6739)
  - 3. "SonogROUT 10K ", Degussa Building Systems, Inc (800-243-6739)

- D. Interior Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.
- E. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

## 2.05 CONCRETE FILL AND REINFORCING MATERIALS

- A. Concrete Materials and Properties: Comply with requirements of Section 03 30 00, and as shown on Drawings, with minimum 28-day compressive strength of 3,000 PSI, unless otherwise indicated.
- B. Non-slip Aggregate Finish: Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rustproof and non-glazing; unaffected by freezing, moisture, or cleaning materials.
- C. Reinforcing Bars: ASTM A615, Grade 60, unless noted otherwise.

## 2.06 PAINT

- A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead and chromate-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of SSPC-Paint 25.
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Carbozinc 621"; Carboline Co. (800-848-4645)
    - b. b.
    - c. "Tneme-Zinc 90-97"; Tnemec Co. (800-863-6321)
- B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC Paint 20.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC Paint 12 except containing no asbestos fibers.
- D. All steel to be fireproofed shall not be primed.
- E. Aluminum Roof Shade Canopy:
  - 1. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - a. Color: As shown on Exterior Finish Index.

## 2.07 FABRICATION - GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Allow for thermal movement resulting from the following maximum change (range) of exterior metalwork in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss. Temperature Change (Range): [120] Degrees F., ambient; [130] degrees F., material surfaces.

- C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts. Locate joints where least conspicuous.
- D. Weld corners and seams continuously to comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- F. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

## **2.08 FABRICATION - ALUMINUM ROOF SHADE CANOPY**

- A. Where practical, fit and assemble metal-framed skylights in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Fabricate aluminum components before finishing.
- C. Fabricate aluminum components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Accommodations for thermal and mechanical movements.
- D. Reinforce aluminum components as required to receive fastener threads.

## **2.09 ROUGH HARDWARE**

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

## **2.10 STEEL FRAMED STAIRS**

- A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, railings newels, balusters, struts, clips, brackets, bearing plates, and other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.
- B. At Contractor's option, provide custom fabricated stairs or prefabricated stair assemblies with metal pan-type treads, attached to installed stringers using manufacturer's standard connection detail.
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:

- a. Sharon Stairs by Duvinage, LLC (800-541-2645)
  - b. American Stair Corporation, Inc. (800-872-7824)
  - c. Approved substitution
- 3. Required Tread Styles:
  - a. Concrete Fill Pan-Type Treads
- 4. Tread Finish:
  - a. At locations shown not to be covered with finish materials provide a non-slip aggregate finish with factory-packaged abrasive aggregate made from fused aluminum-oxide grits or crushed emery, rust-proof and non-glazing.
- C. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual"
- D. Fabrication, General
  - 1. Form steel stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on Shop Drawings, using proven details of fabrication and support.
  - 2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
  - 3. Shear and punch metals cleanly and accurately.
  - 4. Remove sharp or rough areas on exposed surfaces.
  - 5. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
  - 6. Weld corners and seams continuously to comply with the following:
    - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    - b. Obtain fusion without undercut or overlap.
    - c. Remove welding flux immediately.
    - d. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.
  - 7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts. Locate joints where least conspicuous.
  - 8. Shop Assembly: Preassemble in shop to greatest extent possible to minimize field splicing and assembly. Use connections that maintain structural value of joined pieces. Clearly mark units for field assembly and coordinated installation.
- E. Stair Framing: Fabricate stringers of structural steel channels. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers, newels, and framing members to stringers and headers. If using bolts, fabricate and join so that bolts are not exposed on finish surfaces.
  - 1. Where masonry walls support steel stairs, provide temporary supporting struts designed for erection of steel stair components before installation of masonry.
  - 2. Provide plate welded to top of stringer scribed to wall, to close off all gaps between stringers and walls.
- F. Metal Pan Risers, Subtreads, and Subplatforms: Shape metal pans for risers and subtreads to conform to configuration shown. Provide thicknesses of structural steel sheet for metal pans indicated, but not less than that required, to support total design loading.
  - 1. Form metal pans of uncoated cold-rolled steel sheet, or hot rolled when approved in advance by Architect.
  - 2. Directly weld risers and subtreads to stringers; locate welds on side of metal pans to be concealed by concrete fill.

- G. Provide subplatforms of configuration and construction indicated; if not indicated, of same metal as risers and subreads, in thicknesses required to support design loading. Attach subplatform to platform framing members with welds.
- H. For stair railings and handrails requirements, refer to Section 05520 (05 52 00)

## **2.11 STEEL LADDERS**

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, and anchorages as indicated. Comply with requirements of ANSI A14.3.
  - 1. For elevator pit ladders, comply with ASME A17.1.
- B. Siderails: Continuous, steel, 1/2" x 2-1/2" flat bars, with eased edges, space 18" apart.
- C. Bar Rungs: 3/4" diameter steel bars, spaced 12" o.c.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points space not more than 5' o.c. with welded or bolted steel brackets.
- F. Provide nonslip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufacture rung that is filled with aluminum-oxide grout.
- G. Provide ladder safety cages where required by local codes, to comply with ANSI A14.3.

## **2.12 LOOSE BEARING AND LEVELING PLATES**

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

## **2.13 LOOSE STEEL LINTELS**

- A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Hot-dipped galvanize loose steel lintels located in exterior walls.
- C. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, if not indicated on Drawings.

## **2.14 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Spacing of anchors shall not be more than 24" o.c.

## **2.15 PIPE BOLLARDS**

- A. ASTM A153 galvanized schedule 40 steel pipe with concrete fill, as detailed on Drawings. Provide smooth radius for concrete top to prevent accumulation of rainwater. Provide field painted finish.

## **2.16 CAST EXTERIOR STAIR NOSINGS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Model No. Type 116"; by Wooster Products, Inc. (800-321-4936)



2. "Model BT-300L"; Balco, Inc. (800-767-0082)
  3. Approved Substitution
- C. Provide units with integral abrasive grit cast into surface. 1/16" deep cross hatch pattern.
1. Abrasive: Alumogrit
  2. Anchors: Concealed, slotted rivet type, integrally cast into nosing.
  3. Size:
    - a. Nose Depth: 1 inch
    - b. Tread Width: 3 inches
- D. Apply bituminous paint to concealed bottoms, sides, and edges of units set into concrete.

## 2.17 LAUNDRY TRENCH GRATE

- A. Manufactures:
1. Preferred Manufacturers:
    - a. None:
  2. Approved Manufacturers:
    - a. "Kordek PFR Isophthalic Polyester Resin", Seasafe, Inc. (800-326-8842)
    - b. "Fibergrate Molded Gratings", 1" x 1" x 4"; Fibergrate Composite Structures, Inc., An RPM Company (800-527-4043)
    - c. "Molded Square Fiberglass Gratings"; McNichols Co. (800-237-3828)
- B. Provide square-mesh fiberglass grating, solid compression molded structure, 1" thick x size required, with bearing bars spaced at maximum 1" on center.
- C. Accessories:
1. 1/2" round steel bars for lint screen.
- D. Frame: Construct perimeter frame using 1" x 3" x 3/16" seat angle welded to 3" x 3" x 3/16" support steel angle to form seat for trench grate. Weld corners and grind smooth. Grate to be removable.
- E. Forming and Finishing:
1. Form laundry trench using fabricated perimeter frame and concrete forms as required to depth and shape indicated.
  2. Set top of perimeter seat angle flush with finish floor, allowing for thickness of finish material.

## 2.18 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.
- C. Galvanize shelf angles to be installed in exterior walls.

## 2.19 MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
1. Galvanize miscellaneous framing and supports in exterior locations and where shown to be painted.

## 2.20 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for "Architectural and Metal Products" for recommendations relative to application and designations of finishes..
1. Finish metal fabrications after assembly.

## 2.21 STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process in compliance with the following requirements:
  - 1. ASTM A153 for galvanizing iron and steel hardware.
  - 2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Paint Systems: Review painting specifications for finish paint systems. Coordinate surface preparations of steel and type of primer used with specifications and the manufacturer's recommendations to insure compatibility.
- C. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications: Interiors (SSPC Zone 1A): SSPC SP 6/NACE No. 3, "Commercial Blast Cleaning".
- D. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting, and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

## EXECUTION

### 3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

### 3.02 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correctly welding work, and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

### **3.03 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on shop drawings, if any.
- B. Anchor supports securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
  - 1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

### **3.04 SETTING BEARING AND LEVELING PLATES**

- A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set leveling and bearing plates on wedges, shims, or leveling nuts. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
  - 1. Use nonmetallic nonshrink grout, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### **3.05 INSTALLING PIPE BOLLARDS**

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope group up approximately 1/8" toward bollard.
- B. Paint bollards yellow in front of dumpsters.

### **3.06 TOUCH-UP PAINTING**

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC PA 1 requirements for touch-up of field painted surfaces.
- B. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- C. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

**END OF SECTION**

**SECTION 05 52 00**  
**METAL RAILINGS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Interior Railings
  - 2. Exterior Railings
- B. Related Sections:
  - 1. Section 03 30 00 (03300) - Cast-In-Place Concrete
  - 2. Section 05 50 00 (05500) - Metal Fabrications
  - 3. Section 05 73 00 (05720) - Ornamental Handrails and Railings
  - 4. Section 06 20 00 (06200) - Finish Carpentry: Wood Top Cap
  - 5. Section 09 90 00 (09900) - Painting
  - 6. Section 09 96 00 (09960) - High Performance Coatings: For Exterior Railings

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. A36 "Standard Specification for Carbon Structural Steel".
  - 2. A47 "Standard Specification for Ferritic Malleable Iron Castings"
  - 3. A48 "Standard Specification for Gray Iron Castings"
  - 4. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
  - 5. A780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings"
  - 6. B633 "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel"
  - 7. C1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)"
  - 8. E488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"
  - 9. E985 "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings"
- B. American Iron and Steel Institute (AISI) Publications:
  - 1. SG02 "North American Specification for the Design of Cold-Formed Steel Structural Members"
- C. American Welding Society (AWS) Publications:
  - 1. D1.1 "Structural Welding Code - Steel"
  - 2. D1.3 "Structural Welding Code - Sheet Steel"
- D. Federal Specifications (FS) Publications:
  - 1. DOD-P-21035A (formerly MIL-P-21035), Galvanizing Repair Specification
- E. National Association of Architectural Metal Manufacturers (NAAMM) Publications:
  - 1. "Metal Finishes Manual"
  - 2. "Metal Stairs Manual"
- F. The Society for Protective Coatings (SSPC) Publications:
  - 1. PA - Paint Application Standards, Guides, and Specifications
    - a. PA 1 "Shop, Field, and Maintenance Painting of Steel"
  - 2. SP - Surface Preparation Standards and Specifications
    - a. SP 7 "Brush-Off Blast Cleaning"
  - 3. Paint - Paint and Coating Standards and Specifications
    - a. Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film)
    - b. Paint 20 "Zinc-Rich Coating, Type I - Inorganic and Type II - Organic"
    - c. Paint 25 (superceeds FS TT-P-664), Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel

### 1.03 DEFINITIONS

- A. Definitions in ASTM E985 for railing-related terms apply to this Section.

### 1.04 PERFORMANCE REQUIREMENTS

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
1. For Cold-Formed Structural Steel: AISI SG02 "North American Specification for Design of Cold-Formed Steel Structural Members".
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
    - a. Designed to resist a load of [50] pounds per linear foot (pound per foot) applied in any direction at the top and to transfer this load through the supports to the structure.
    - b. Concentrated Load: Handrail assemblies and guards shall be able to resist a single concentrated load of [200] pounds applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building. This load need not be assumed to act concurrently with the loads specified in the paragraph above.
  2. Intermediate Rails (all those except the handrail), balusters and panel fillers: Capable of withstanding the following loads applied as indicated.
    - a. Designed to withstand a horizontally applied normal load of 50 pounds on an area not to exceed 1 square foot including openings and space between rails.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of handrails and railings to prevent buckling, opening up of joints, overstressing of components, connections, and other detrimental effects. Base design calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
1. Temperature Change (Range): [120] deg. F. ambient; [180] deg. F. materials surfaces.

### 1.05 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
1. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project.
    - a. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of railing components and systems with requirements based on comprehensive testing of current products.
  2. Shop Drawings showing fabrication and installation of handrails and railings including plans, elevations, sections, details of components, and attachments to other units of Work.
    - a. Where installed products are indicated to comply with certain design loadings, include structural computations, materials properties, and other information needed for structural analysis that has been signed and sealed by a qualified professional engineer responsible for their preparation.
  3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
    - a. Quality welding processes and welding operators in accordance with the following:
      - 1) AWS D1.1 "Structural Welding Code - Steel"
      - 2) AWS D1.3 "Structural Welding Code - Sheet Steel"

## 1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.
- B. Engineering Responsibility: Engineer handrails and railing systems by qualified professional engineer legally authorized to practice in jurisdiction where Project is located.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

## 1.08 PROJECT CONDITIONS

- A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
  - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

## 1.09 SEQUENCING

- A. Sequence and coordinate installation of handrails and railings as follows:
  - 1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
  - 2. Mount handrails only on gypsum board assemblies reinforced to receive anchors and where the location of concealed anchor plates has been clearly marked for benefit of installer. Do not support temporarily by any means that does not satisfy structural performance requirements.

## PRODUCTS

### 2.01 METALS

- A. General: Provide metal forms and types that comply with requirements of referenced standards and that are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Steel Pipe: ASTM A53; finish, type, and weight class as follows:
  - 1. Black finish, unless otherwise indicated.
  - 2. Galvanized finish where indicated.
  - 3. Type S, Grade A, standard weight (Schedule 40), unless otherwise indicated, or another weight required by structural loads.
- C. Steel Plates, Shapes, and Bars: ASTM A36
- D. Gray Iron Castings: ASTM A48, Class 30
- E. Malleable Iron Castings: ASTM A47, Grade 32510
  - 1. Bracket:
    - a. Preferred Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) "Model 382"; Julius Blum & Co., Inc. (800-526-6293)
      - 2) Approved Substitution
- F. Fittings: Steel Elbows, Tee-Shapes, Wall Brackets, Escutcheons
- G. Mounting: Brackets and Flanges: Steel inserts for casting or setting in new and existing concrete and with steel brackets for embedding into masonry.

- H. Cast-In-Place and Post-Installed Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E488, conducted by a qualified independent testing laboratory.
1. Sleeves: For steel posts set in concrete, fabricate sleeves from steel pipe not less than 6 inches long with an inside diameter not less than 1/2 inch greater than the outside diameter of post, with steel plate closure welded to bottom of sleeve.

## **2.02 GROUT AND ANCHORING CEMENT**

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this Section.
- B. Preferred Manufacturers:
1. None
- C. Approved Manufacturers:
1. "Euco N-S Grout", Euclid Chemical Co, An RPM Company; (800-321-7628)
  2. "Masterflow 713", Degussa Building Systems, Inc (800-243-6739)
  3. "SonogROUT 10K", Degussa Building Systems, Inc (800-243-6739)
- D. Interior Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.
- E. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

## **2.03 PAINT**

- A. Refer to Section 09 96 00 (09960) for Special Coatings used for exterior railings.
- B. Shop Primer for Ferrous Metal: Manufacturers or Fabricators standard, fast-curing, lead and chromate-free, primer with performance requirements in FS TT-P-664; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Carbozinc 621"; Carboline Co. (800-848-4645)
    - b. "Epoxy Zinc-Rich Primer CM18/CM19"; Benjamin Moore & Co. (888-236-6667)
    - c. "Tneme-Zinc 90-97"; Tnemec Co. (800-863-6321)
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC Paint 20.
- D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC Paint 12 except containing no asbestos fibers and complying with ASTM D1187.

## **2.04 WELDING MATERIALS, FASTENERS, AND ANCHORS**

- A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.

1. For steel railings and fittings use plated fasteners complying with ASTM B633, Class Fe/Zen 25 for electro-deposited zinc coating.
  2. Cast-In-Place and Post-Installed Anchors in Concrete: Anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E488, conducted by a qualified independent testing laboratory.
  3. Sleeves: For steel posts set in concrete, fabricate sleeves from steel pipe not less than 6 inches long with an inside diameter not less than 1/2 inch greater than the outside diameter of post, with steel plate closure welded to bottom of sleeve.
- C. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.
  2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

## 2.05 FABRICATION

- A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.
- B. Preassemble railing systems in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of jointed pieces. Clearly mark units for reassembly and coordinated installation.
- C. Form changes in direction of railing members as shown on Drawings.
- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Welded Connections: Fabricate railing systems and handrails for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.
  5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- F. Nonwelded Connections: Fabricate railing systems and handrails for connection of members by means of railing manufacturer's standard concealed mechanical fasteners and fittings to produce flush, smooth, rigid, hairline joints.
1. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer's standard splicing method.
- G. Brackets, Flanges, Fittings and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings and anchors for interconnection of handrail and railing members to other work, unless otherwise indicated.



- H. Provide inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work. Fabricate anchorage devices which are capable of withstanding loadings imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.
- I. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- J. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- K. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- L. For handrails and railing systems that are exposed to exterior or to moisture from condensation or other sources, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing members.
- M. Fabricate joints that will be exposed to weather in a manner to exclude water.
- N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- O. Fillers: Provide steel sheet or plate fillers of thickness and size n indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

## 2.06 STEEL FINISHES

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variation in appearance of other components is acceptable if they are within range of approved samples and they are assembled or installed to minimize contract.
- D. Interior:
  - 1. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications.
    - a. Interiors (SSPC Zone 1A): SSPC SP7 "Brush-Off Blast Cleaning".
  - 2. Apply shop primer to uncoated surfaces of handrails and railing components, except those with galvanized finish or to be embedded in concrete or masonry, unless otherwise indicated. Comply with requirements of SSPC PA1 "Paint Application Specification No. 1" for shop painting.
    - a. Preferred Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) "Carbozinc 621"; Carboline Co. (800-848-4645)
      - 2) "Epoxy Zinc-Rich Primer CM18/CM19"; Benjamin Moore & Co. (888-236-6667)
      - 3) "Tneme-Zinc 90-97"; Tnemec Co. (800-863-6321)
  - 3. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.
- E. Exterior:
  - 1. Refer to Section 09 96 00 (09960) for Special Coatings used for exterior railings.

## **EXECUTION**

### **3.01 PREPARATION**

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.

### **3.02 INSTALLATION**

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installation of handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
  - 1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.
  - 3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- D. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railings to in-place construction.

### **3.03 ANCHORING POSTS**

- A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.
- B. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete where shown on Drawings. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.
- C. Anchor posts in concrete by core drilling holes, where shown on drawings, not less than 5 inches deep and 3/4 inch greater than outside diameter of post. Clean holes of all loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.
  - 1. Nonshrink, nonmetallic grout or anchoring cement.

### **3.04 RAILING CONNECTIONS**

- A. Nonwelded Connections: Use manufacturer's standard mechanical for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws with plastic filler cement colored to match finish of handrails and railing systems.

- B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fittings designed for this purpose.

### **3.05 ANCHORING RAIL ENDS**

- A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post-installed anchors and bolts.
- B. Anchor rail end to metal surfaces with oval or round flanges.

### **3.06 ATTACHMENT OF HANDRAILS TO WALLS**

- A. Attach handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2 inch clearance from inside face of handrail and finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and wall return fittings to building construction as follows:
  - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
  - 2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
  - 3. For hollow masonry anchorage, use toggle bolts with square heads.
  - 4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

### **3.07 ADJUSTING AND CLEANING**

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.
- B. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

### **3.08 PROTECTION**

- A. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop. Make required alterations and refinish entire unit or provide new units.

### **END OF SECTION**

**SECTION 05 73 00**  
**DECORATIVE METAL RAILINGS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Aluminum Ornamental Handrails and Railing Systems
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete
  - 2. Section 04 20 00 - Masonry Units
  - 3. Section 05 52 00 - Handrails and Railings: For handrails and railings fabricated from round pipe and tube components.
  - 4. Section 08 71 00 - Door Hardware
- C. Products Supplied But Not Installed Under This Section:
  - 1. Inserts and anchors preset in masonry and concrete for anchorage of handrails and railing systems.

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. E985 "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings"
  - 2. B26 "Standard Specification for Aluminum-Alloy Sand Castings"
  - 3. B151 "Standard Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar"
  - 4. B209 "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate"
  - 5. B210 "Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes"
  - 6. B221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes"
  - 7. B247 "Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings"
  - 8. B429 "Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube"
  - 9. C1007 "Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories"
- B. American Welding Society (AWS) Publications:
  - 1. D1.2 "Structural Welding Code--Aluminum"
- C. American Society of Civil Engineers (ASCE) Publications:
  - 1. ASCE 7, "Minimum Design Loads for Buildings and Other Structures"
- D. Aluminum Association (AA) Publications:
  - 1. "Aluminum Design Manual 2000: Specifications for Aluminum Structures"

**1.03 DEFINITIONS**

- A. Definitions in ASTM E985 for railing-related terms apply to this Section.

**1.04 PERFORMANCE REQUIREMENTS**

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Aluminum: AA "Specifications for Aluminum Structures"
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the structural loads required by ASCE 7 and the following without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
  - 1. Handrails and Guards: Capable of withstanding the following loads applied as indicated:

- a. Designed to resist a load of [50] pounds per linear foot (pound per foot) applied in any direction at the top and to transfer this load through the supports to the structure.
  - b. Concentrated Load: Handrail assemblies and guards shall be able to resist a single concentrated load of [200] pounds applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building . This load need not be assumed to act concurrently with the loads specified in the paragraph above.
- 2. Intermediate Rails (all those except the handrail), balusters and panel fillers: Capable of withstanding the following loads applied as indicated.
  - a. Designed to withstand a horizontally applied normal load of 50 pounds on an area not to exceed 1 square foot including openings and space between rails.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of handrails and railings to prevent buckling, opening up of joints, overstressing of components, connections, and other detrimental effects. Base design calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
  - 1. Temperature Change (Range): [120] deg. F. ambient; [180] deg. F. materials surfaces.

## 1.05 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
  - 1. Product data for each type of product specified.
  - 2. Shop Drawings showing fabrication and installation of handrails and railings including plans, elevations, sections, details of components, and attachments to other units of Work.
    - a. Where installed products are indicated to comply with certain design loadings, include structural computations, materials properties, and other information needed for structural analysis that has been signed and sealed by a qualified professional engineer responsible for their preparation.
  - 3. Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors available for those units with factory-applied color finishes.
  - 4. Samples for verification purposes of each type of exposed finish required, prepared on components indicated below that are of the same thickness and metal indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
    - a. Six inch long sections of each distinctly different linear railing member including handrails, top rails, posts, and balusters.
  - 5. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of railing components and systems with requirements based on comprehensive testing of current products.

## 1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.
- B. Engineering Responsibility: Engineer handrails and railing systems by qualified professional engineer legally authorized to practice in jurisdiction where Project is located.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

## 1.07 STORAGE AND PROTECTION

- A. Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

## 1.08 PROJECT/SITE CONDITIONS

- A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
  - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

## 1.09 SEQUENCING

- A. Sequencing and Scheduling
  - 1. Sequence and coordinate installation of handrails and railings as follows:
    - a. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
    - b. Mount handrails only on gypsum board assemblies reinforced to receive anchors and where the location of concealed anchor plates has been clearly marked for benefit of installer.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Sterling Dula Railings"; Kane Manufacturing Corp. (814-838-7731)
  - 2. Julius Blum & Co. Inc. (800-526-6293)
  - 3. J.G. Braun Company, The Wagner Companies (888-243-6914)
  - 4. C.R. Laurence Co, Inc.(800-421-6144)
  - 5. Approved substitution

### 2.02 METALS

- A. General: Provide metal forms and types that comply with requirements of referenced standards and that are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.
  - 1. Extruded Bar and Tube: ASTM B221, Alloy 6063-T5
  - 2. Extruded Structural Pipe and Tube: ASTM B429, Alloy 6063-T6
  - 3. Drawn Seamless Tube: ASTM B210, Alloy 6063-TB32
  - 4. Plate and Sheet: ASTM B209, Alloy 6061-T6
  - 5. Die and Hand Forgings: ASTM B247, Alloy 6061-T6
  - 6. Castings: ASTM B26, Alloy A356-T6
- C. Nickel Silver:
  - 1. Extruded Bar and Tube: ASTM B151, Alloy UNS No. C79800.

### 2.03 GROUT AND ANCHORING CEMENT

- A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this Section.
- B. Preferred Manufacturers:
  - 1. None
- C. Approved Manufacturers:

1. "Euco N-S Grout", Euclid Chemical Co. An RPM Company; (800-321-7628)
  2. "Masterflow 713", Degussa Building Systems, Inc (800-243-6739)
  3. "SonogROUT 10K", Degussa Building Systems, Inc (800-243-6739)
- D. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

## 2.04 MATERIALS

- A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Additional protection at railing/gate lock/panic bar: Provide 1/4" thickness clear Lexan panels, or 1/4" aluminum wire mesh with selvaged edges, trim with aluminum C-channel. Paint channel or mesh to match fence color. Extend Lexan 20" below panic bar and 20" above panic bar or to top of fence if less than 20". Extend mesh/Lexan 20" to each side of panic bar to prevent access to panic bar from opposite side. Provide clear Lexan with non-scratch coating, at locations noted on the Drawings.
- C. Lock: Refer to Section 08 71 00 - Coordinate keying with other hardware used in job.
- D. Hinge: Spring Hinge in 304 stainless steel; 3 knuckle, anti-friction bearings and lifetime warranty.
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "2060-R Series"; Stanley Hardware (800-337-4393)

## 2.05 FASTENERS

- A. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.
1. For aluminum railings, provide fasteners fabricated from Type 304 stainless steel.
- B. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.

## 2.06 FABRICATION

- A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than that required to support structural loads.
- B. Preassemble railing systems in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Gates:
1. Construct using same type material, finish, and design as adjacent railings or fencing.
  2. Provide diagonal bracing as required to resist a minimum downward force of 75 lbs. on the latch jamb.
- D. Fabrication Tolerances:
1. Top Rail and Post Dimensions: +/- 1/4"

2. Pickets and Bottom Rail Dimensions: +/- 1/8"

## **2.07 ALUMINUM FINISHES**

- A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. Finish: Baked acrylic over phosphate pretreatment with inhibitive primer complying with AAMA 603.8. Color: See Exterior and Interior Finish Indexes.

## **EXECUTION**

### **3.01 PREPARATION**

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorage's, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.

### **3.02 INSTALLATION**

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
  1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
  2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.
  3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members to not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum alloys which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint or zinc chromate primer.
- D. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings to in-place construction.

### **3.03 RAILING CONNECTIONS**

- A. Mechanical Connections: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  1. Fabricate splice joints for field connection using epoxy structural adhesive where this is manufacturer's standard splicing method.
- B. Expansion Joints: Install expansion joints no further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side. Fasten internal sleeve securely to one side. Locate joint within 6" of post.

### **3.04 ANCHORING POSTS**

- A. Anchor posts in concrete by core drilling holes not less than 5 " deep and 3/4 inch greater than outside diameter of post. Clean holes of all loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.
  1. Nonshrink, nonmetallic grout.
- B. Anchor posts to metal surfaces with oval flanges, angle type or floor type as required by conditions, connected to posts and to metal supporting members as follows:
  1. For aluminum railings, attach posts as indicated using manufacturer's standard fittings designed and engineered for this purpose.



2. Install using Styrofoam inserts placed in the concrete by use of base plates welded to the aluminum posts using fasteners into the concrete deck.

### **3.05 ANCHORING RAIL ENDS**

- A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post-installed anchors and bolts.
- B. Anchor rail ends to metal surfaces with oval or round flanges.

### **3.06 ADJUSTING AND CLEANING**

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material.
- B. Clean the following metals by washing thoroughly with clean water and soap, following by rinsing with clean water.
  1. Aluminum

### **3.07 PROTECTION**

- A. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop. Make required alterations and refinish entire unit or provide new units.

**END OF SECTION**

**SECTION 06 10 00**  
**ROUGH CARPENTRY**

**GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Framing with the following:
    - a. Dimension Lumber
    - b. Engineered Wood Products
      - 1) Laminated Veneer Lumber (LVL)
      - 2) Parallel Strand Lumber (PSL)
      - 3) Laminated Strand Lumber (LSL)
    - c. Wood-Based Structural-Use Panels
      - 1) Subflooring
      - 2) Underlayment
      - 3) Wall Sheathing
      - 4) Roof Sheathing
      - 5) Backing Panels
    - d. Wood-Preservative Treated Materials
    - e. Fire-Retardant-Treated Materials
    - f. Wall Sheathings
      - 1) Gypsum Wall Sheathing
      - 2) Fiberboard Wall Sheathing
      - 3) Extruded-Polystyrene-Foam Wall Sheathings
  - 2. Fasteners
  - 3. Metal Framing Anchors
  - 4. Rooftop Equipment Bases and Support Curbs
  - 5. Wood Furring, Grounds, Nailers, and Blocking
- B. Related Sections:
  - 1. Section 06 15 16 (06150) - Wood Roof Decking
  - 2. Section 06 17 53 (06175) - Shop-Fabricated Wood Trusses
  - 3. Section 06 18 00 (06185) - Glued-Laminated Construction
  - 4. Section 06 20 00 (06200) - Finish Carpentry for nonstructural carpentry items exposed to view and not specified in another Section.
  - 5. Section 07 42 33 (07420) - Solid Phenolic Exterior Wall Panels
  - 6. Section 07 46 46 (07460) - Fiber Cement Siding
  - 7. Section 07 53 23 (07530) - Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
  - 8. Section 08 14 00 (08200) - Wood Doors
  - 9. Section 09 21 16 (09255) - Gypsum Board Assemblies
  - 10. Section 10 28 00 (10800) - Toilet, Bath, and Laundry Equipment
  - 11. Section 12 30 00 (06400) - Architectural Woodwork
  - 12. Section 12 36 23 (06415) - Plastic Countertops
  - 13. Section 12 36 40 (09380) - Stone Countertops
  - 14. Section 12 36 61.13 (06610) - Cultured Marble Countertops
  - 15. Section 12 36 61.16 (06620) - Solid Surfacing Countertops

**1.02 REFERENCES**

- A. The American Forest & Paper Association (AFPA') Publications:
  - 1. "National Design Specifications for Wood Construction"
  - 2. "Wood Frame Construction Manual (WFCM) for One- and Two-Family Dwellings"
- B. American Lumber Standards Committee (ALSC)
  - 1. DOC PS 20, "American Softwood Lumber Standard"
  - 2. DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood"

3. National Grading Rule (NGR)
- C. American Wood-Preservers's Association (AWPA) Publications:
  1. C2 "Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes"
  2. C9 "Plywood - Preservative Treatment by Pressure Process Document Number"
  3. M4 "Standard for the Care of Preservative-Treated Wood Products Document Number"
- D. ASTM International Publications:
  1. A153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
  2. A307 "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength"
  3. A563 "Standard Specification for Carbon and Alloy Steel Nuts"
  4. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  5. B117 "Standard Practice for Operating Salt Spray (Fog) Apparatus"
  6. C27 "Standard Classification of Fireclay and High-Alumina Refractory Brick"
  7. C208 "Standard Specification for Cellulosic Fiber Insulating Board"
  8. C578 "Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation"
  9. C846 "Standard Practice for Application of Cellulosic Fiber Insulating Board for Wall Sheathing"
  10. 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. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness"
  11. C1177 "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing"
  12. D2559 "Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions"
  13. D2898 "Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing"
  14. D5055 "Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists"
  15. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
  16. E699 "Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components"
  17. F1667 "Standard Specification for Driven Fasteners: Nails, Spikes, and Staples"
- E. The Engineered Wood Association (APA) Publications:
  1. Form No. E30, "APA Engineered Wood Construction Guide"
- F. Single Ply Roofing Industry (SPRI) Publications

### 1.03 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.
- B. Dimension Lumber: Lumber that is precut in width and thickness to a standard size of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project.
  1. Engineered wood products
  2. Underlayment
  3. Insulating sheathing

4. Metal framing anchors
5. Construction adhesives
- C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.
- D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
  1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
  2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
  3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.
- E. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.
- F. Warranty of chemical treatment manufacturer for each type of treatment.
- G. Shop Drawings:
  1. For Engineered Wood Framing Systems provide layout drawings indicating materials, member sizes, member spacing and accessories required for proper installation. Drawings shall clearly reference construction details, loading assumptions (including location of loads transferred from other levels), and minimum live load and total load deflection criteria.
    - a. Where installed products are indicated to comply with certain design loadings, include structural computations, materials properties, and other information needed for structural analysis that has been signed and sealed by a qualified professional engineer responsible for their preparation.
  2. Details for joining, supporting, and securing wood blocking required for metal roof edge flashings, including gravel stops and copings, designed in accordance with SPRI Wind Design Standards.
- H. Research or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence the following products' compliance with building code in effect for Project.
  1. Engineered wood products
  2. Metal framing anchors
  3. Power-driven fasteners
  4. Fire-retardant-treated wood
    - a. National Evaluation Service, Inc. or approved substitution.

#### **1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Owner's Representative satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- B. Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by a single producer.
- C. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood product from one source and by a single manufacturer.
- D. Engineering Responsibility: Engineered Wood Framing Systems shall be engineered by qualified professional engineer legally authorized to practice in jurisdiction where Project is located.

- E. Product Identification: All Engineered Wood Products System members shall be clearly marked with manufacturer's name, product series, plant identification, date of manufacture, and code compliance.
- F. Installation Review: The Engineered Wood Products System Manufacturer's Technical Representative shall be available to meet with the Contractors to review installation details prior to the beginning of framing. The Contractor shall give notification to the Technical Representative prior to enclosing the framing to provide opportunity for review of the installation.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
  - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
  - 2. Store Engineered Wood materials on dry surfaces supported on raised wood sticks located every 10 feet. Store TJI joists in an upright position.

## **PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. Laminated-Veneer Lumber (LVL):
  - 2. Parallel-Strand Lumber (PSL):
  - 3. Prefabricated Wood I-Joists (TJI):
  - 4. Laminated Strand Lumber (LSL):
  - 5. Oriented Strand Board (OSB)
- B. Approved Manufacturers:
  - 1. Wood-Preservative-Treated Materials:
    - a. "Micro-Guard"; Hoover Treated Wood Products, Inc. (800-531-5558)
    - b. "MicroPro"; Osmose, Inc. (800-241-0240)
  - 2. Fire-Retardant-Treated Materials, Interior Type A:
    - a. "Dricon FRT"; Lonza Wood Protection (678-627-2000)
    - b. "Pryro-Guard"; Hoover Treated Wood Products, Inc. (800-531-5558)
    - c. "FirePRO"; Osmose, Inc. (800-241-0240)
  - 3. Fire-Retardant-Treated Materials, Exterior Type:
    - a. "FRX Exterior FRT"; Lonza Wood Protection (678-627-2000)
    - b. "Exterior Fire-X"; Hoover Treated Wood Products, Inc. (800-531-5558)
  - 4. Laminated-Veneer Lumber (LVL):
    - a. "VERSA-LAM"; Boise Building Solutions (800-232-0788)
    - b. "Gang-Lam LVL"; Louisiana-Pacific Corp. (800-999-9105)
    - c. "Microllam LVL"; TrusJoist by Weyerhaeuser (800-456-4787)
  - 5. Parallel-Strand Lumber (PSL):
    - a. "Parallam PSL"; TrusJoist by Weyerhaeuser (800-456-4787)
  - 6. Prefabricated Wood I-Joists (TJI):
    - a. Boise Building Solutions (800-232-0788)
    - b. Louisiana-Pacific Corp. (800-999-9105)
    - c. TrusJoist by Weyerhaeuser (800-456-4787)
  - 7. Laminated Strand Lumber (LSL):
    - a. TrusJoist by Weyerhaeuser (800-456-4787)
  - 8. Oriented Strand Board (OSB)
    - a. "Structurwood Sheathing"; TrusJoist by Weyerhaeuser (800-456-4787)
    - b. Approved Substitution
  - 9. Glass-Fiber-Surfaced Gypsum Sheathing Board:
    - a. "DensGlass Sheathing"; Georgia-Pacific Corp. (800-284-5347)

- b. "GlasRoc Enhanced Glass Reinforced Gypsum Sheathing"; CertainTeed Corporation, a subsidiary of Saint-Gobain (800-233-8990)
  - c. "Securock Glass-Mat Sheathing"; United States Gypsum Co. (800-950-3839)
  - d. "Gold Bond Brand e2XP Extended Exposure Sheathing"; National Gypsum Company. (800-628-4662)
  - e. "GreenGlass Fiberglass-Faced Gypsum Sheathing"; Temple-Inland Forest Products Corp. - Gypsum Products (800-231-6060)
10. Metal Framing Anchors:
- a. Hilti, Inc. (800-879-8000)
  - b. Cleveland Steel Specialty Co. (800-251-8351)
  - c. USP Lumber Connectors (800-328-5934)
  - d. Simpson Strong-Tie Company, Inc. (800-999-5099)
  - e. EMCO/Southeastern Metals/A Gibraltar Co. (800-690-7235)

## 2.02 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
  - 1. NELMA - Northeastern Lumber Manufacturers Association.
  - 2. NLGA - National Lumber Grades Authority (Canadian).
  - 3. RIS - Redwood Inspection Service.
  - 4. SPIB - Southern Pine Inspection Bureau.
  - 5. WCLIB - West Coast Lumber Inspection Bureau.
  - 6. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
  - 1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 1. Provide dressed lumber, S4S, unless otherwise indicated.
  - 2. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

## 2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
  - 1. Do not use chemicals containing chromium or arsenic.
  - 2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
  - 3. Use treatment that does not promote corrosion of metal fasteners.
- B. Pressure treat above ground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood framing members less than 18 inches above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft.
- D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWP A M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

## 2.04 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of ASTM E84 (lumber) and ASTM C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; SGS U.S. Testing; Timber Products Inspection, Inc; or another testing and inspecting agency acceptable to authorities having jurisdiction.
  1. Provide fire treated wood in all concealed areas of construction, as shown or indicated on the drawings, and as required by code.
  2. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
    - a. Use treatment that does not promote corrosion of metal fasteners.
  3. Research or Evaluation Reports: Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model code research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.
  4. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- B. Interior Type A: For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:
  1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency. Design value adjustment factors shall be calculated according to ASTM D6841.
  2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.
  3. Contact with treated wood does not promote corrosion of metal fasteners.
  4. Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Exterior Type: Use for exterior locations and where indicated. Comply with ASTM D2898.
- D. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively
- E. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

## 2.05 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Non-Load-Bearing Interior Partitions: Provide framing of the following grade and species:
  1. Grade: Construction.
  2. Species: Any species with a modulus of elasticity and an extreme fiber stress in bending as indicated on Drawings
    - a. Exception: Southern (yellow) pine is not permitted, except for treated wood products.

- C. Exterior and Load-Bearing Walls: Provide framing of the following grade and species:
  - 1. Grade: No. 2.
  - 2. Species: Any species with a modulus of elasticity and an extreme fiber stress in bending as indicated on Drawings
    - a. Exception: Southern (yellow) pine is not permitted, except for treated wood products.
- D. Ceilings (Non-Load-Bearing): For ceiling framing that does not support a floor, roof, or attic, provide the following grade and species:
  - 1. Grade: Construction or No. 2.
  - 2. Species: Any species with a modulus of elasticity and an extreme fiber stress in bending as indicated on Drawings
    - a. Exception: Southern (yellow) pine is not permitted, except for treated wood products..
- E. Other Framing Not Listed Above: Provide the following grades and species:
  - 1. Grade: No. 1.
  - 2. Species: Any species with a modulus of elasticity and an extreme fiber stress in bending as indicated on Drawings
    - a. Exception: Southern (yellow) pine is not permitted, except for treated wood products..
- F. Exposed Framing: Provide material hand-selected from lumber of species and grade indicated below for uniformity of appearance and freedom from characteristics that would impair finish appearance.
  - 1. Species and Grade: As indicated above for load-bearing construction of same type.

## 2.06 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 15 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

## 2.07 ENGINEERED WOOD PRODUCTS

- A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.
  - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Laminated-Veneer Lumber: Lumber manufactured by laminating wood veneers in a continuous press using an exterior-type adhesive complying with ASTM D2559 to produce members with grain of veneers parallel to their lengths. Comply with the following requirements:
  - 1. Extreme Fiber Stress in Bending: 2,600 psi for 12-inch nominal-depth members.
  - 2. Modulus of Elasticity: 1,900,000 psi
  - 3. Tension Parallel to Grain: 1,555 psi
  - 4. Compression Parallel to Grain: 2,510 psi
  - 5. Compression Perpendicular to Grain: 750 psi perpendicular to and 480 psi and parallel to glue line.
  - 6. Horizontal Shear: 285 psi perpendicular to and 190 psi parallel to glue line.



- C. Parallel-Strand Lumber: Lumber manufactured by laying up wood strands using an exterior-type adhesive complying with ASTM D2559, and cured under pressure to produce members with grain of strands parallel to their lengths and complying with the following requirements:
1. Extreme Fiber Stress in Bending: 2900 psi for 12-inch nominal-depth members.
  2. Modulus of Elasticity: 2,000,000 psi
  3. Tension Parallel to Grain: 2,025 psi
  4. Compression Parallel to Grain: 2,900 psi
  5. Compression Perpendicular to Grain: 750 psi perpendicular to and 475 psi and parallel to wide face of strands.
  6. Horizontal Shear: 210 psi perpendicular to and 290 psi and parallel to wide face of strands.
- D. Prefabricated Wood I-Joists: Units manufactured by bonding stress-graded lumber flanges to wood-based structural-use panel webs with exterior-type adhesives complying with ASTM D2559, produce I-shaped joists complying with the following requirements:
1. Flange Material: Laminated-veneer lumber.
  2. Flange Material: Southern pine dimension lumber.
  3. Flange Material: Spruce-pine-fir dimension lumber.
  4. Flange Material: Any material indicated above, as standard with joist manufacturer.
  5. Web Material: Oriented-strand board (OSB) complying with DOC PS 2.
  6. Web Material: Plywood complying with DOC PS 2.
  7. Web Material: Either material indicated above, as standard with joist manufacturer.
  8. Provide continuous "Microllam LVL flanges", by TrusJoist by Weyerhaeuser or approved substitution by other listed manufacturers free from finger or scarf joints for the length of the joists.
  9. Provide webs manufactured from "Performance Plus Panels", by TrusJoist by Weyerhaeuser, or approved substitution by other listed manufacturers, with saw tooth edge detail interlocked and glued at panel joints. Joist web material must not exceed 12% tested average thickness swell due to moisture.
  10. Structural Capacities: Establish and monitor structural capacities according to ASTM D5055.
  11. Sizes: Depths and widths as indicated, with flanges not less than 1-1/2 inches in actual width.
- E. Prefabricated Wood Rim Joists:
1. "Timberstrand LSL Rim Joist" as manufactured by TrusJoist by Weyerhaeuser or approved substitution by other listed manufacturers.
  2. Construction: Solid 1-1/4" thick piece of laminated strand lumber sized to match depth of joist.
  3. Design Values:
    - a. MOE =  $1.3 \times 10^6$
    - b. Vertical Load transfer = 4,250 plf (Governed by most restrictive capacity of member or wood plate below)
    - c. Lateral Load transfer = 240 plf
  4. (Case 1) and 180 plf (Case 3), as governed by horizontal diaphragm.
- F. Microllam LVL Beams:
1. "Microllam LVL" as manufactured by TrusJoist by Weyerhaeuser or approved substitution by other listed manufacturers.
  2. Construction: Continuous laminated veneer lumber free from finger or scarf joints. Stress graded veneers bonded with waterproof adhesive with face grain parallel to each adjacent layer. Provide Watershed Overlay coating and edge seal to prevent cupping and moisture damage.
  3. Design Values:
    - a. MOE =  $1.9 \times 10^6$  psi
    - b. Fb = 2600 psi (for 12" depth)

- c.  $F_c1 = 750 \text{ psi}$
  - d.  $F_v = 285 \text{ psi}$ .
- G. Parallam PSL Beams:
  - 1. "Parallam PSL" as manufactured by TrusJoist by Weyerhaeuser, or approved substitution by other listed manufacturers.
  - 2. Construction: Continuous parallel strand lumber bonded with waterproof adhesives and formed into billets. Beams shall be of single ply construction and free from finger joints or splices for full length of span.
  - 3. Design Values:
    - a.  $MOE = 2.0 \times 10^6 \text{ psi}$
    - b.  $F_b = 2900 \text{ psi}$  (for 12" depth)
    - c.  $F_c1 = 750 \text{ psi}$
    - d.  $F_v = 290 \text{ psi}$ .
- H. Laminated Strand Lumber (LSL) Headers:
  - 1. "Timberstrand LSL Headers" as manufactured by TrusJoist by Weyerhaeuser, or approved substitution by other listed manufacturers.
  - 2. Construction: Laminated strand lumber; strands of aspen or yellow poplar bonded with waterproof resins; cured using a steam injection process.
  - 3. Design Values for depths 9.25" or greater:
    - a.  $MOE = 1.5 \times 10^6 \text{ psi}$
    - b.  $F_b = 2250 \text{ psi}$  (for 12" depth)
    - c.  $F_c1 = 775 \text{ psi}$
    - d.  $F_v = 400 \text{ psi}$ .
  - 4. Design Values for depths less than 9.25":
    - a.  $MOE = 1.3 \times 10^6 \text{ psi}$
    - b.  $F_b = 1700 \text{ psi}$  (for 12" depth)
    - c.  $F_c1 = 680 \text{ psi}$
    - d.  $F_v = 400 \text{ psi}$ .

## 2.08 WOOD-BASED STRUCTURAL-USE PANELS, GENERAL

- A. Structural-Use Panel Standards: Provide either all-veneer, mat-formed, or composite panels complying with DOC PS 2, "Performance Standard for Wood-Based Structural-Use Panels," unless otherwise indicated. Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood," where plywood is indicated.
- B. Structural-Use Panel Standard: Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood."
- C. Trademark: Factory mark structural-use panels with APA trademark evidencing compliance with grade requirements.

## 2.09 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

- A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).
  - 1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
  - 2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
- B. Combination Subfloor-Underlayment: APA-rated Sturd-I-Floor.
  - 1. Exposure Durability Classification: Exposure 1.
  - 2. Span Rating: Not less than [16] [20] [24] [32] [48] o.c. [As indicated].
  - 3. Minimum Thickness: [23/32] inches.
  - 4. Edge Detail: Tongue and groove
  - 5. Surface Finish: Fully sanded face.

- C. Combination Subfloor-Underlayment: Oriented-Strand-Board.
  - 1. Exposure Durability Classification: Exposure 1.
  - 2. Span Rating: Not less than [16] [20] [24] [32] [48] o.c. [As indicated].
  - 3. Minimum Thickness: [23/32] inches.
  - 4. Edge Detail: Tongue and groove
- D. Subflooring: APA-rated plywood sheathing.
  - 1. Exposure Durability Classification: Exposure 1.
  - 2. Span Rating: Not less than [16] [20] [24] [32] [48] o.c. [As indicated].
  - 3. Minimum Thickness: [23/32] [7/8] inches.
  - 4. Edge Detail: Tongue and groove
- E. Subflooring: Oriented-Strand-Board.
  - 1. Exposure Durability Classification: Exposure 1.
  - 2. Span Rating: Not less than [16] [20] [24] [32] [48] o.c. [As indicated].
  - 3. Minimum Thickness: [23/32] [7/8] inches.
  - 4. Edge Detail: Tongue and groove
- F. Wall Sheathing: Where indicated on drawings, provide APA-rated plywood sheathing.
  - 1. Exposure Durability Classification: [Exposure 1] [Exposure 1, Structural I].
  - 2. Span Rating: [12/0], [16/0], [20/0], [or Wall] - 16 for stud spacing of 16 inches or less.
  - 3. Span Rating: [24/0], [24/16], [32/16], [or Wall] - 24 for stud spacing of 24 inches or less.
  - 4. Minimum Thickness: As shown on Drawings.
- G. Wall Sheathing - Oriented-Strand-Board:
  - 1. Exposure Durability Classification: [Exposure 1, Structural I] [Exposure 1]
  - 2. Span Rating: [16/0], [20/0], [24/0], [24/16] [32/16]
  - 3. Minimum Thickness: As shown on Drawings.
- H. Roof Sheathing: APA-rated plywood sheathing.
  - 1. Exposure Durability Classification: [Exposure 1] [Exposure 1, Structural I].
  - 2. Span Rating: Not less than [16/0] [20/0] [24/0] [32/16] [40/20] [48/24] [As indicated].
  - 3. Minimum Thickness: [15/32 inches].
- I. Roof Sheathing - Oriented-Strand-Board:
  - 1. Exposure Durability Classification: [Exposure 1, Structural I] [Exposure 1]
  - 2. Span Rating: [16/0], [20/0], [24/0], [24/16] [32/16] [40/20] [48/24]
  - 3. Minimum Thickness: As shown on Drawings.

## **2.10 STRUCTURAL-USE PANELS FOR BACKING**

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick.

## **2.11 STRUCTURAL-USE PANELS FOR UNDERLAYMENT**

- A. General: Over smooth subfloors, provide underlayment not less than 1/4 inch thick. Over board or uneven subfloors, provide underlayment not less than 11/32 inch thick.
- B. Plywood Underlayment for Resilient Flooring: For underlayment under 19/32 inch-thick, provide plywood panels with fully sanded face and as follows:
  - 1. Grade: APA Underlayment Exposure 1.

## **2.12 GYPSUM SHEATHING**

- A. Glass-Fiber-Surfaced Gypsum Sheathing Board: Gypsum sheathing board consisting of noncombustible gypsum core incorporating a water-resistant material, surfaced on face and back with glass-fiber mats with alkali-resistant coating, and with unsurfaced square edges; complying with ASTM C1177, and requirements indicated below:
  - 1. Type: [Regular] [Type X] or as noted on the drawings.
  - 2. Thickness: [1/2"] [5/8"] unless indicated otherwise.

### 2.13 FIBERBOARD WALL SHEATHING

- A. ASTM C208, Type IV, Grade [1 (Regular)] [2 (Structural)] cellulosic fiberboard sheathing with square edges, [1/2 inch] [25/32 inch] thick.

### 2.14 EXTRUDED-POLYSTYRENE-FOAM WALL SHEATHING

- A. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
  - 1. Thickness: As shown on Drawings.

### 2.15 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A153 or of Type 304 stainless steel.
  - 2. For fasteners and hardware used with treated wood products, comply with manufacturer's recommendations for their intended use.
- B. Nails, Wire, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
  - 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Attach sheathing to comply with ASTM C954.
- G. Lag Bolts: ASME B18.2.1.
- H. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.

### 2.16 METAL FRAMING ANCHORS

- A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:
  - 1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
  - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
  - 3. For metal framing anchors used with treated wood products, comply with manufacturer's recommendations for their intended use.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653, G60 coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

- C. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.
  - 1. Thickness: 0.052 inch.
  - 2. Thickness: 0.064 inch.
- D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
  - 1. Strap Width: 1-1/2 inches.
  - 2. Strap Width: 2 inches.
  - 3. Thickness: 0.052 inch.
  - 4. Thickness: 0.064 inch.
  - 5. Designed for connection of engineered wood products, sized to support design loads.
- E. Bridging: Rigid, V-section, nailless type, 0.064 inch thick, length to suit joist size and spacing.
- F. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch minimum side cover, socket 0.064 inch thick, standoff and adjustment plates 0.108 inch thick.
- G. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
  - 1. Width: 3/4 inch.
  - 2. Width: 1-1/4 inches.
  - 3. Thickness: 0.052 inch.
  - 4. Thickness: 0.064 inch.
  - 5. Length: As indicated.
- H. Rafter Tie-Downs (Hurricane Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-5/8 inches wide by 0.052 inch thick.
- I. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.052 inch thick by 36 inches long.
- J. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of 2 bolts placed 7 bolt diameters from reinforced base.
  - 1. Bolt Diameter: 5/8 inch.
  - 2. Bolt Diameter: 3/4 inch.
  - 3. Width: 2-1/2 inches.
  - 4. Width: 3-3/16 inches.
  - 5. Body Thickness: 0.108 inch.
  - 6. Body Thickness: 0.138 inch.
  - 7. Base Reinforcement Thickness: 0.180 inch.
  - 8. Base Reinforcement Thickness: 0.239 inch.
  - 9. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
- K. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

## 2.17 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

## EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Published requirements of metal framing anchor manufacturer.
  - 2. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction." And "Details for Conventional Wood Frame Construction"
  - 3. "Table 2304.9.1 - Fastening Schedule" of the International Building Code.
- F. Secure blocking for roof edge systems, such as copings or gravel stops, in accordance with SPRI Wind Design Standards as specified in Section 07 62 00 "Flashing and Sheet Metal" and the requirements of the International Building Code.
- G. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- H. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
- I. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

### 3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
  - 1. Wood blocking or nailers used to attach roof edge system components shall be designed and installed to resist the design wind load and shall be firmly attached to the masonry structure to provide a continuous load path in accordance with SPRI Wind Design Standards. For wood nailers wider than 6-inches fasteners shall be staggered to avoid splitting the wood.
  - 2. Blocking for Solid Phenolic Exterior Wall Panel Rain Screen System: Install blocking as required to support Solid Phenolic Exterior Wall Panel Rain Screen System components as detailed on the Drawings.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.03 WOOD FURRING

- A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

1. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.
- B. Furring to Receive Plywood Paneling: Install 1-by-3-inch nominal-size furring at 24 inches o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring at 16 inches o.c., vertically.

### **3.04 WOOD FRAMING, GENERAL**

- A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Install framing members of size and at spacing indicated.
- D. Do not splice structural members between supports.
- E. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal-thickness lumber of same width as framing members.
- F. Comply with Table 2304.9.1 and Section 2304 of the International Building Code for minimum fastening requirements of wood members, and published requirements of metal fastener manufacturer, whichever is more stringent.

### **3.05 WALL AND PARTITION FRAMING**

- A. General: Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction, unless otherwise indicated.
- B. Construct corners and intersections with 3 or more studs. Provide miscellaneous blocking and framing as shown and as required to support facing materials, fixtures, specialty items, and trim.
  1. Provide continuous horizontal blocking at midheight of single-story partitions and multistory partitions, using members of 2-inch nominal thickness and of same width as wall or partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
  1. For non-load-bearing partitions, provide double-jamb studs with headers not less than 4-inch nominal depth for openings 36 inches and less in width, and not less than 6-inch nominal depth for wider openings.
  2. For load-bearing walls, provide double-jamb studs for openings 72 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth shown or, if not shown, as recommended by AFPA's "Manual for Wood Frame Construction."
- D. Provide bracing in exterior walls, at both walls of each external corner, full-story height, unless otherwise indicated. Provide one of the following:
- E. Provide bracing in walls, at locations indicated, full-story height, unless otherwise indicated. Provide one of the following:
  1. Diagonal bracing at 45-degree angle using let-in 1-by-4-inch nominal-size boards or using metal bracing.
  2. Plywood panels, not less than 48 by 96 inches applied vertically.
  3. Performance-rated structural-use panels, not less than 48 by 96 inches applied vertically.
  4. Particleboard sheathing panels, not less than 48 by 96 inches applied vertically.
  5. In lieu of bracing at corners or at locations indicated, continuous gypsum sheathing may be provided in panels not less than 48 by 96 inches applied vertically.

6. In lieu of bracing at corners or at locations indicated, continuous fiberboard sheathing, intermediate type, may be provided in panels not less than 48 by 96 inches applied vertically.

### 3.06 FLOOR JOIST FRAMING

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
  1. Where supported on wood members, by toe nailing or by using metal framing anchors.
  2. Where framed into wood supporting members, by using wood ledgers as shown or, if not shown, by using metal joist hangers.
- B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.
- C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- D. Do not notch in middle third of joists; limit notches to 1/6 depth of joist, 1/3 at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.
- E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
- F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c. extending over and fastening to 3 joists. Embed anchors at least 4 inches into masonry with ends bent at right angles 4 inches into grouted masonry.
- H. Under jamb studs at openings, provide solid blocking between joist.
- I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
  1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.
  1. Diagonal wood bridging formed from bevel cut 1-by-3-inch nominal-size lumber, double-crossed and nailed both ends to joists.
  2. Steel bridging installed to comply with bridging manufacturer's written instructions.
  3. Bridging may be omitted where joist depth is 12-inch nominal size or less, and where indicated live load is 40 psf or less.
- K. Prefabricated Wood I-Joists:
  1. Comply with manufacturer's written instructions for design, installation, and fastening.
  2. Design Loads: Joists shall be sized to support loads indicated on drawings and reviewed by a Registered Engineer in the employ of the joist manufacturer.
  3. Allowable deflection:
    - a. Floor Joists: L/480 live load deflection; L/240 total load deflection.
  4. Permanently bond the subfloor to the joists using waterproof construction adhesive and nails.
  5. End Bearing: 1-3/4" minimum bearing with Timberstrand LSL rim joist.
  6. Intermediate bearing: 3-1/2" minimum bearing. Blocking panels shall be installed between the joists when load bearing walls are located above the bearing point.
- L. Engineered Wood Beams
  1. Comply with manufacturer's written instructions for design, installation, and fastening.
  2. Design Loads: Beams shall be sized to support loads indicated on drawings.
  3. Allowable deflection:
    - a. Floor Beams: L360 live load deflection; L240 total load deflection.



- b. Roof Beams: L/180 total load deflection.
- 4. Protect wood members from direct contact with concrete or masonry.
- 5. Refer to manufacturers literature for connection of multiple plies of side loaded beams.

### 3.07 RAFTER AND CEILING JOIST FRAMING

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
  - 1. Where ceiling joists are at right angles to rafters, provide additional short joists perpendicular to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-size or 2-by-4-inch nominal-size stringers spaced 48 inches o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
  - 1. At valleys, provide double-valley rafters of size shown or, if not shown, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
  - 2. At hips, provide hip rafter of size shown or, if not shown, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as shown or, if not shown, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as shown for eaves, overhangs, dormers, and similar conditions, if any.
- E. Prefabricated Wood I-Joists:
  - 1. Comply with manufacturer's written instructions for design, installation, and fastening.
  - 2. Design Loads: Joists shall be sized to support loads indicated on drawings and reviewed by a Registered Engineer in the employ of the joist manufacturer.
  - 3. Allowable deflection:
    - a. Roof Joists: L/360 live load deflection; L/240 total load deflection
  - 4. Permanently bond the subfloor to the joists using waterproof construction adhesive and nails.
  - 5. End Bearing: 1-3/4" minimum bearing with Timberstrand LSL rim joist.
  - 6. Intermediate bearing: 3-1/2" minimum bearing. Blocking panels shall be installed between the joists when load bearing walls are located above the bearing point.
- F. Engineered Wood Beams
  - 1. Comply with manufacturer's written instructions for design, installation, and fastening.
  - 2. Design Loads: Beams shall be sized to support loads indicated on drawings.
  - 3. Allowable deflection:
    - a. Floor Beams: L360 live load deflection; L240 total load deflection.
    - b. Roof Beams: L/180 total load deflection.
  - 4. Protect wood members from direct contact with concrete or masonry.
  - 5. Refer to manufacturers literature for connection of multiple plies of side loaded beams.

### 3.08 STAIR FRAMING

- A. Provide stair framing members of size, space, and configuration indicated or, if not otherwise indicated, to comply with the following requirements:
  - 1. Stringer Size: 2-by-12-inch nominal-size minimum.
  - 2. Notching: Notch stringers to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
  - 3. Stringer Spacing: At least 3 stringers for each 36-inch clear width of stair.
- B. Provide stair framing that does not exceed the following variations between treads and risers within each flight:

1. Adjacent Treads and Risers: 3/16 inch.
2. Between Largest and Smallest Treads and Risers: 3/8 inch.

### **3.09 INSTALLATION OF STRUCTURAL-USE PANELS**

- A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
  1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Securely attach to substrate by fastening as indicated, complying with the following:
  1. ICC NER-272 for power-driven fasteners.
  2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- D. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.
- E. Fastening Methods: Fasten panels as indicated below:
  1. Combination Subflooring-Underlayment: Glue and nail to framing throughout.
  2. Subflooring: Glue and nail to framing throughout.
    - a. Space panels 1/8 inch at edges and ends.
  3. Sheathing:
    - a. Nail to wood framing.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch at edges and ends.
  4. Underlayment: Nail to subflooring.
    - a. Space panels 1/32 inch at edges and ends.
    - b. Fill and sand edge joints of underlayment receiving resilient flooring just before installing flooring.
  5. Plywood Backing Panels: Nail or screw to supports.
  6. Lay-out panels with face grain oriented perpendicular to the supporting members.
  7. Install roof sheathing with panel cups at all edges.

### **3.10 GYPSUM SHEATHING**

- A. General: Install gypsum sheathing to comply with manufacturer's instructions, GA-253, and the following:
  1. Cut boards at penetrations, edge, and other obstructions of the work. Fit tightly against abutting construction, except provide a 3/8" setback where non-load-bearing construction abuts structural elements.
  2. Coordinate sheathing installation with flashing and joint sealant installation so that these combined materials are installed in the sequence and manner that prevents exterior moisture from passing through completed exterior wall assembly.
  3. Apply fasteners so that screw heads bear tightly against face of gypsum sheathing boards, but do not cut into face paper.
  4. Do not bridge building expansion joints with gypsum sheathing. Cut and space edges to match spacing of structural support elements.
- B. Vertical Installation: Install four-foot-wide gypsum sheathing boards vertically with vertical edges centered over flanges of studs. Abut ends and edges of each board with those of adjoining boards. Screw-attach boards at perimeter and within field of board to each steel stud as follows:
  1. Fasteners spaced approximately 8" o.c. and set-back 3/8" minimum from edges and ends of boards.

### **3.11 FIBERBOARD SHEATHING INSTALLATION**

- A. Comply with ASTM C846 and with manufacturer's written instructions.

1. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails[ or galvanized staples]; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch from edges and ends.
2. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch open space between edges and ends of adjacent units. Stagger horizontal joints if any.
3. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

### **3.12 FOAM-PLASTIC SHEATHING INSTALLATION**

- A. Comply with manufacturer's written instructions.
- B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

### **3.13 PROTECTION**

- A. Protect wood that has been treated with inorganic boron from weather. If inorganic boron treated wood becomes wet, apply EPA registered borate treatment to wood surfaces in accordance with manufacturers recommendations.
- B. Protect Gypsum Sheathing from weather by covering exposed exterior surface, if required by manufacturer of gypsum sheathing.

**END OF SECTION**

**SECTION 06 20 00**  
**FINISH CARPENTRY**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Wood Millwork
    - a. Interior Standing and Running Trim
    - b. Exterior Standing and Running Trim
  - 2. Wood Shelving
  - 3. Pre-Packaged Floating Wood Soffit and Lighting System at Guestrooms
- B. Related Sections:
  - 1. Section 32 31 29 (02825) - Wood Fences and Gates
  - 2. Section 06 10 00 (06100) - Rough Carpentry
  - 3. Section 07 46 46 (07460) - Fiber-Cement Siding
  - 4. Section 08 80 00 (08800) - Glazing
  - 5. Section 09 21 16 (09255) - Gypsum Board Assemblies
  - 6. Section 09 90 00 (09900) - Paints and Coatings
  - 7. Section 12 30 00 (06400) - Architectural Woodwork

**1.02 REFERENCES**

- A. American Wood Council / American Forest & Paper Association (AF&PA) Publications:
  - 1. ANSI/AF&PA NDS-2005: "National Design Specification (NDS) for Wood Construction".
- B. AWI Quality Standards
- C. American Wood-Preservers's Association (AWPA) Publications:
  - 1. C20 "Structural Lumber - Fire-Retardant Treatment by Pressure Processes"
- D. ASTM International Publications:
  - 1. E84-03: Test Method for Surface-Burning Characteristics of Building Materials
  - 2. A153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
  - 3. C1185 "Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards."
  - 4. C1186 "Standard Specification for Flat Non-Asbestos Fiber-Cement Sheets."
- E. U.S. Department of Commerce, National Institute of Standards and Technology (NIST)
  - 1. DOC PS 1 "Construction and Industrial Plywood"
  - 2. DOC PS 20 "American Softwood Lumber Standard"
- F. Hardwood Plywood & Veneer Association (HPVA)
  - 1. ANSI/HPVA HP-1: "American National Standard for Hardwood and Decorative Plywood"

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit Product Data and Shop Drawings indicating component profiles and fastening and joining details.
  - 2. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
  - 3. Samples for verification of the following:
    - a. Lumber products with factory-applied finish, 50 sq. in. for lumber for each finish system and color.

#### 1.04 QUALITY ASSURANCE

- A. Factory-mark each piece of lumber and plywood with type, grade, mill, and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.
- B. Perform finish carpentry work in accordance with AWI Quality Standards, Custom Grade.
- C. Fire-Test-Response Characteristics: Provide glass-reinforced gypsum fabrications with the following surface-burning characteristics as determined by testing identical products per ASTM E84 by UL or another independent testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Flame Spread: 25 or less.
  - 2. Smoke Developed: 450 or less.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect finish carpentry materials during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.
- B. Do not deliver finish carpentry materials, until painting, wet work, grinding, and similar operations which could damage, soil, or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

#### 1.06 COORDINATION

- A. Pre-packaged Floating Wood Soffit and Lighting System:
  - 1. Lead Times for Soffit Systems:
    - a. General Contractor shall allow a minimum delivery lead time of [6 to 8] weeks after final approval of Shop Drawings.
  - 2. The Pre-packaged Floating Wood Soffit and Lighting System is a millwork and lighting system that requires the contractor to maintain critical dimensions in the field during the framing and Gypsum Board installation phase of the Project in advance of the installation of the soffit, in order to be able to install the soffit system successfully when it arrives.
  - 3. There is no scribe allowance in the system.
  - 4. The area must also be roughed-in by the electrician correctly in advance.
  - 5. Framing Templates: Milton W. Bosley Company provides the following templates to ensure the proper distances between the walls in X and Y axes, and the sizes of the Notches in the Walls to be framed and finished by the Contractor.
    - a. "Bosley Template FFS-FSLED-TEMP-1": This Template locates the Bottom Plates relative to the center of the space.
    - b. "Bosley Template FFS-FSLED-TEMP-2": This Template locates the Top Plates and the size of the framing member at the top of the Notches, relative to the Bottom Plates.
  - 6. Lead Times for Templates
  - 7. Anticipated Ship Date is to be 2 to 3 Weeks after Order Confirmation

#### 1.07 PROJECT CONDITIONS

- A. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas.
- B. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels throughout the remainder of construction period.
  - 1. Maintain temperature and humidity in installation area as required to maintain moisture content of installed finish carpentry within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator

of woodwork shall determine optimum moisture content and required temperature and humidity.

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

## **PRODUCTS**

### **2.01 MATERIALS, GENERAL**

- A. Lumber standards: Comply with DOC PS 20, "American Softwood Lumber Standard," for lumber and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
  - 1. Northeastern Lumber Manufacturers Association (NeLMA)
  - 2. National Lumber Grades Authority (Canadian) (NLGA)
  - 3. Redwood Inspection Service (RIS)
  - 4. SPIB - Southern Pine Inspection Bureau
  - 5. West Coast Lumber Inspection Bureau (WCLIB)
  - 6. Western Wood Products Association (WWPA)
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
  - 1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.
- D. Softwood Plywood: Comply with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood."
- E. Hardwood Plywood: Comply with ANSI/HPVA HP-1, "Interim Voluntary Standard for Hardwood and Decorative Plywood."

### **2.02 INTERIOR STANDING AND RUNNING TRIM**

- A. Hardwood Lumber: PS 58; Premium Grade in accordance with AWI; maximum moisture content of 15 percent.
  - 1. Stained Interior Wood Trim and Millwork: Species as shown below, solid lumber stock, sizes and shapes shown on Drawings, of grain type sufficient to receive stained finish, smooth surfaced.
    - a. Hard Maple - "Select White" (Sapwood), plain (flat) sliced, Grade 1
    - b. Yellow Birch - "Select White" (Sapwood), plain (flat) sliced, Grade 1
  - 2. Painted Interior Wood Trim and Millwork: Species as shown below, solid lumber stock, sizes and shapes shown on Drawings, of grain type sufficient to receive painted finish, smooth surfaced.
    - a. Poplar, Paint Grade
- B. Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.

### **2.03 WOOD EXTERIOR STANDING AND RUNNING TRIM**

- A. Lumber Trim: Provide finished lumber and moldings complying with the following requirements including those of the grading agency listed with species:
  - 1. Species: Redwood or Western Red Cedar; WCLIB, grade as follows:
    - a. Cedar Grade: Select and Quality Knotty
    - b. Redwood Grade: Clear
  - 2. Texture: Smooth Surfaced

3. Lumber for Transparent Finish (Stained or Clear): Solid lumber stock.

## **2.04 MISCELLANEOUS MATERIALS**

- A. Fasteners and Anchorages: Provide nails, screws, and other anchoring devices of the type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications. Provide in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer.
  1. Where finish carpentry is exposed on exterior or in areas of high relative humidity, provide fasteners and anchorages with a hot-dipped zinc coating (ASTM A153), or stainless steel.

## **2.05 SHEET MATERIALS**

- A. Shelving: 3/4" thick by width shown on Drawings, Hardwood Plywood: PS 51; custom grade in accordance with AWI; core material of veneer; type of bond recommended for application; with minimum 3/4" x 1-1/4" hardwood nosing.
- B. Interior Wood Column Surround: 3/4" thick by width shown on Drawings, Hardwood Veneered Plywood: PS 51; custom grade in accordance with AWI; core material of veneer; type of bond recommended for application.
  1. Veneer Species: Hard Maple - "Select White" (Sapwood), plain (flat) sliced

## **2.06 FIRE RETARDANT TREATED (FRT) LUMBER**

- A. Preferred Manufacturers:
  1. None
- B. Approved Manufacturers:
  1. Lumber:
    - a. Dricon FRT"; Lonza Wood Protection (678-627-2000)
    - b. "Pyro-Guard"; Hoover Treated Wood Products, Inc. Hoover Treated Wood Products (877-722-6292, ext. 211)
    - c. "FirePRO FR Lumber"; Osmose Wood Preserving, Inc. (404-228-8434)
  2. Plywood:
    - a. "FRX Exterior FRT"; Lonza Wood Protection (678-627-2000)
    - b. "Exterior Fire-X"; Hoover Treated Wood Products, Inc. (877-722-6292, ext. 211)
- C. Comply with performance requirements in AWPA C20, Exterior type. Kiln dry after treatment to a maximum moisture content of 19 percent.
- D. Flamespread and smoke developed ratings of 25 or less by ASTM E84, with no sign of progressive combustion when test is extended to 30 minutes.
- E. Toxicity/IEQ: Fire-retardant-treated wood products shall be free of halogens, sulfates, ammonium phosphate and formaldehyde.
  1. Fire retardant chemicals Environmental Protection Agency (EPA) registered and accepted.

## **2.07 PRE-PACKAGED FLOATING WOOD SOFFIT AND LIGHTING SYSTEM**

- A. Preferred Manufacturers:
  1. None
- B. Approved Manufacturers:
  1. "Model FFS-FSLED"; The Milton W. Bosley Company (800-638-5010)
- C. Components:
  1. Bottom Face and All Sides:
    - a. Materials: 3/4-inch, 3-ply MDF-Core Khaya Mahogany Veneer-Faced Plywood with Balanced Back, and with Wood Blocking Interior Structure
    - b. Construction:
      - 1) All bottom corners and all vertical corners to be mitered
      - 2) Provide solid wood and/or plywood interior structure as needed

- 3) Rear dog-leg of soffit to be removable for installation as needed. Manufacturer shall ensure grain match to adjacent section of soffit by cutting parts from adjacent area of raw material.
- 4) Transformer for lighting system to be installed in interior of soffit at factory
- 5) No seams or joints are allowed in the exposed bottom face of soffit and no vertical seams or joints are allowed in the exposed sides or ends of the soffit except at removable rear dog-leg.
- c. Finish:
  - 1) Color: Refer to Interior Finish Index
  - 2) Top Coat: Standard Lacquer Finish
2. Removable Top Panel:
  - a. Materials: 3/4-inch, MDF
    - 1) Prefinished with White Primer on exterior exposed face only.
  - b. Construction:
    - 1) Top panel to be removable to provide access to interior for wire management as needed.
    - 2) Top panel to have lighting installed at factory, with hole for wire management as needed.
    - 3) Removable top panel to be shipped inverted for protection of lighting system.
3. Lighting System:
  - a. Materials: LED Strips, Connectors and Power Transformer Kit: "Hafele Model 833.73.07X.M"
  - b. Lighting Specifications: "Model FFS-H-73.07X": Qty 54 LEDs, 3000K Color Temperature LED Fixture, 1-12VDC Power Transformer

## **2.08 FABRICATION - WOOD FINISH CARPENTRY**

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry on relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate finish carpentry to dimensions, profiles, and details indicated.
  1. Back out or kerf backs of the following members, except members with ends exposed in finished work:
    - a. Interior standing and running trim, except shoe mold and crown mold.
  2. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1-1/6 inch (1.5 mm) radius.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerance and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Clean substrates of projections and substances detrimental to application.
- B. Condition finish carpentry to average prevailing humidity conditions in installation areas before installation, for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.
- C. Prime and backprime lumber for painted finish exposed on the exterior not indicated as factory prefinished. Comply with requirements for surface preparation and application in Division 09 Section "Painting."
- D. Ensure that all electrical or other services are in place.



### **3.03 INSTALLATION - FINISH CARPENTRY**

- A. Discard units of material which are unsound, warped, bowed, twisted improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install the work plumb, level, true, and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.
- C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- D. Countersink nails, fill surface flush, and sand where face nailing is unavoidable.
- E. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) for plumb and level. Install adjoining finish carpentry with 1/32 inch (0.8 mm) maximum offset for flush installation and 1/16 inch (1.5 mm) maximum offset for reveal installation.
- F. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim and rails. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.
- G. Finish according to specified requirements.
- H. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

### **3.04 INSTALLATION - STANDING AND RUNNING TRIM**

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, if required.
  - 1. Match color and grain pattern across joints.
  - 2. Install trim after gypsum board joint finishing operations are completed.
  - 3. Drill pilot holes in hardwood before fastening to prevent spitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
  - 4. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

### **3.05 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION**

- A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up factory-applied finishes to restore damaged or soiled areas.
- C. Preparation for Finishing: Sand work smooth and set all nails and screws. Apply wood filler in exposed nail and screw indentations.
- D. Cleaning: Keep premises in a neat, safe, and orderly condition at all times during execution of this portion of the work, free from the accumulation of sawdust, cut-ends, and debris.
- E. Refer to Division 09 sections for final finishing of installed finish carpentry work.

- F. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

**END OF SECTION**

**SECTION 06 25 00**  
**PREFINISHED PANELING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Factory-Finished Wood Flooring Used for Wood Paneling.
- B. Related Sections:
  - 1. Section 06 20 00 (06200) - Finish Carpentry
  - 2. Section 09 68 00 (09680) - Carpeting

**1.02 REFERENCES**

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit manufacturer's product and maintenance data for each type of wood flooring (paneling).
  - 2. Certification by wood flooring (paneling) and adhesive manufacturers that products supplied for paneling installation comply with local regulations controlling use of volatile organic compounds (VOCs).
  - 3. Submit samples in the form of actual sections of wood flooring (paneling) showing full range of colors and texture variations expected.
  - 4. Shop Drawings: Show installation details including location and layout of each type of wood paneling and accessory.
  - 5. For composite wood products, documentation indicating that the bonding agent contains no urea formaldehyde.

**1.04 QUALITY ASSURANCE**

- A. Single-Source Responsibility for paneling: Obtain each type, and color of paneling from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.
- B. Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated.
  - 1. Acceptable to or licensed by manufacturer.
- C. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect wood paneling materials from exposure to moisture. Do not deliver wood paneling materials until building is enclosed, after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry and HVAC System is operating and will maintain temperature and relative humidity at required levels for the remainder of the construction period.
- B. Store wood paneling materials in dry spaces protected from the weather with ambient temperatures maintained between 60 degrees F. and 80 degrees F. Store paneling materials on flat surfaces. Move paneling and installation accessories into spaces where they will be installed at least seven (7) days in advance of installation.

## 1.06 PROJECT CONDITIONS

- A. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood paneling during the conditioning period.
  - 1. Conditioning period shall begin not less than seven days before wood paneling installation, is continuous through installation, and continues not less than seven days after wood paneling installation.
- B. Wood Paneling Conditioning: Move wood paneling into spaces where it will be installed, no later than the beginning of the conditioning period.
  - 1. Do not install wood paneling until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
  - 2. Open sealed packages to allow wood paneling to acclimatize immediately on moving paneling into spaces in which it will be installed.
- C. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- D. Install factory-finished wood paneling after other finishing operations, including painting, have been completed.

## 1.07 SEQUENCING AND SCHEDULING

- A. Do not install wood paneling materials until related units of Work specified in other Sections has been completed.

## 1.08 EXTRA MATERIALS

- A. Refer to Section 01 78 43 (01790)

## PRODUCTS

### 2.01 MANUFACTURERS:

- A. Avendra, LLC Preferred Manufactures:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Engineered Hardwood with Hardwood Core"; Shaw Hospitality Group, A Shaw Industries Company (888-683-0197)

### 2.02 WOOD PANELING:

- A. Engineered-Wood, Plank Flooring:
  - 1. Species: Kupy (Handscraped)
  - 2. Grade: Suitable for all levels
  - 3. Thickness: 3/8 inch
  - 4. Construction: 5-ply engineered with all hardwood core
  - 5. Width: 5" Plank
  - 6. Length: 10" to 58.50"
  - 7. Edge Style: Four-sided Micro Beveled
  - 8. Finish: Shaw Commercial-Grade UV urethane with Aluminum Oxide.
  - 9. Wear Layer Thickness 0.0714"
  - 10. Texture: Smooth
  - 11. Grain/Color Variation: Low
  - 12. Sheen: Medium
  - 13. Installation: Adhesive
  - 14. Greenguard Certified and CARB compliant.
- B. Product Selection:
  - 1. Model No.: Refer to Interior Finish Index.
  - 2. Color and Finish: Refer to Interior Finish Index.

## **2.03 INSTALLATION ACCESSORIES**

- A. Trowelable Leveling and Patching Compound: Portland-cement-based formulation approved by paneling manufacturer.
- B. Adhesives: As recommended by manufacturer.
  - 1. Adhesive shall be Shaw Greenguard Certified Adhesive.
- C. Trim: In same specie and grade as wood paneling, finished to match, unless otherwise specifically indicated.
- D. Other materials, including items not specifically described, but required for a complete and proper installation of wood paneling, shall be only as recommended by the manufacturer of material to which it is applied.

## **EXECUTION**

### **3.01 INSPECTION:**

- A. Installer must examine the areas and conditions under which paneling and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
  - 1. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
  - 2. For adhesively applied wood paneling, verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
  - 3. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the substrate. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

### **3.02 PREPARATION**

- A. General: Comply with manufacturer's installation specifications for preparing substrates to receive products indicated.
- B. Clean substrates to be covered by wood paneling materials immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Remove coatings, adhesives, plastics, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone. Surface to receive new paneling shall be prepared, including removal of existing materials not acceptable for proper installation of new materials, as required by manufacturer. Do not use solvents.
- D. Use leveling compound as recommended by manufacturer for filling small cracks and depressions in walls.

### **3.03 INSTALLATION**

- A. Install paneling after finishing operations, including painting, have been completed. Building air temperature, and relative humidity must be within limits recommended by paneling manufacturer's directions.
- B. Patch and repair walls to receive paneling for proper installation of paneling and accessories.
- C. Place paneling with adhesive cement in strict compliance with manufacturer's recommendations. Provide expansion space at perimeters and terminations as recommended by manufacturer.
- D. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

- E. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on paneling. Use chalk or other non-permanent marking device.
- F. Tightly cement paneling to substrate without open cracks, voids, raising and puckering at joints, telegraphing of substrate conditions, or other surface imperfections.
- G. Except as specifically indicated install paneling with grain in tile running in same direction.
- H. Scribe, cut, and fit paneling to butt neatly to adjacent surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings. Leave space for expansion.
- I. If Nails are used, fill nail holes with matching filler where exposed.

**3.04 CLEANING AND PROTECTION:**

- A. Repair damaged and defective paneling, where possible, to eliminate defects; where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Protect paneling against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by manufacturer of product involved.
- C. Clean products specified in this Section not more than four days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products using method recommended by manufacturer. Perform initial maintenance including cleaning and polishing in accordance with manufacturer's instructions.

**END OF SECTION**

**SECTION 07 10 00**  
**DAMPPROOFING AND WATERPROOFING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Sheet Membrane Waterproofing
  - 2. Under-Slab-On-Grade Vapor Retarder
- B. Related Sections:
  - 1. Section 03 30 00 (03300) - Cast-In-Place Concrete
  - 2. Section 04 20 00 (04200) - Unit Masonry
  - 3. Section 07 20 00 (07200) - Thermal Protection

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. D4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method"
  - 2. D6506 "Standard Specification for Asphalt Based Protection for Below Grade Waterproofing"
  - 3. E1745 "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs"
  - 4. E1643 "Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs"

**1.03 SYSTEM DESCRIPTION**

- A. General: Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current sheet membrane.

**1.04 SUBMITTALS**

- A. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) with the following supporting data:
  - 1. Include product data on each type of dampproofing and waterproofing product specified, including data substantiating that materials comply with specified requirements.
    - a. Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this project.
- B. Samples, 3 x 6 inches minimum size, of each fluid-applied and sheet membrane waterproofing material specified for Project.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage an experienced Installer who has completed fluid-applied and sheet membrane waterproofing applications similar in material, design, and extent to that indicated for Project and that has resulted in construction with a record of successful in-service performance.
  - 1. Assign work closely associated with waterproofing, including (but not limited to) waterproofing accessories, and flashings used in conjunction with waterproofing, expansion joints in membrane, insulation, and protection course on membrane, to Installer of fluid-applied waterproofing, for single, undivided responsibility.
- B. Single-Source Responsibility: Obtain primary waterproofing materials of each type required from a single manufacturer.
- C. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer" name, product, date of manufacturer, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.

## **1.07 PROJECT CONDITIONS**

- A. Environmental Conditions: Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
  - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during penetration and application of waterproofing materials.

## **PRODUCTS**

### **2.01 MATERIALS, GENERAL**

- A. General Compatibility: Provide products that are recommended by manufacturer to be fully compatible with indicated substrates.

### **2.02 SHEET MEMBRANE WATERPROOFING**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Bituthene 4000"; Grace Construction Products (800-444-6459)
  - 2. "CCW MiraDRI 860/861"; Carlisle Coatings and Waterproofing Inc. (800-527-7092)
  - 3. "650 Waterproofing Membrane"; Polyguard Products Inc. (800-541-4994)

### **2.03 UNDER-SLAB-ON-GRADE VAPOR BARRIER:**

- A. Vapor Barrier Under-Slabs-On-Grade:
  - 1. Plastic Vapor Retarder: ASTM E1745, Class A, with maximum performance rating of 0.01 perm as tested before and after mandatory conditioning (ASTM E1745 Section 7.1 and sub-paragraphs 7.1.1-7.1.5). Provide in lengths and widths required for least number of seams.
    - a. Under Slab: 15 mils thick.
  - 2. Accessories:
    - a. Vapor- Barrier Seam Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
    - b. Penetrations of Vapor Barrier: Mastic or Vapor Barrier Seam Tape.
    - c. Perimeter and Edge Seal: Double sided tape, or tape with textured surface. Use of one-sided seaming tape to seal perimeter must be approved by the [Owner's Representative] [Architect] prior to installation.
  - 3. Manufacturers:
    - a. "Stego Wrap (15 mil) Vapor Barrier"; Stego Industries, LLC (877-464-7834)
    - b. "Perminator (15 mil) Underslab Vapor Retarder"; W.R. Meadows, Inc. (800-342-5976)
    - c. "Griffolyn (15 mil) Griffiolyne a Division of Reef Industries ) (800-231-6074)
    - d. "Moistop Ultra (15 mil)"; Fortifiber Corporation (800-773-4777)
    - e. "Viper VaporCheck (16 mil)"; Insulation Solutions, Inc. (866-698-6562)
    - f. "VaporBlock 15"; Raven Engineered Films Division, Raven Industries (800-635-3456)

### **2.04 UNDER-SLAB-ON-GRADE VAPOR RETARDER:**

- A. Vapor Retarder Under-Slabs-On-Grade:
  - 1. Plastic Vapor Retarder: ASTM E1745, Class C, with maximum performance rating of 0.04 perm. Provide in lengths and widths required for least number of seams.
    - a. Under Slab: 10 mils thick.



2. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
3. Manufacturers:
  - a. "Stego Wrap (10 mil) Vapor Barrier"; Stego Industries, LLC (877-464-7834)
  - b. "Vapor-Mat (10 mil) Underslab Vapor Retarder"; W.R. Meadows, Inc. (800-342-5976)
  - c. "Moistop Plus"; Fortifiber Corporation (800-773-4777)
  - d. "Viper VaporCheck (10 mil)"; Insulation Solutions, Inc. (866-698-6562)
  - e. "VaporBlock 10"; Raven Engineered Films Division, Raven Industries (800-635-3456)

## 2.05 MISCELLANEOUS MATERIALS

- A. In addition to primary waterproofing materials, provide the following:
  1. Primer/Filler/Sealer: As recommended by waterproofing manufacturer.
  2. Flashings, Cant Strips, and Accessories: As recommended by waterproofing manufacturer.
  3. Protection Course: Board as approved by system manufacturer, premolded, 1/8 inch (3 mm) thick, semirigid board consisting of mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, surface-coated with asphalt and sealed to core under heat and pressure, and provided with polyethylene film facings complying with ASTM D6506.

## EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions under which waterproofing systems will be applied, with Installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.
  1. Do not proceed with installation until after minimum concrete curing period recommended by waterproofing manufacturer.
  2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
- B. Inspect concrete and concrete masonry surfaces for:
  1. Contamination: Algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, mildew or other foreign substances.
  2. Surface absorption and chalkiness.
  3. Cracks: Measure crack width and record location of cracks.
  4. Damage and deterioration.
  5. Moisture content and moisture damage:
    - a. Use a moisture meter to determine if the surface is dry enough to receive the air and moisture barrier and record any areas of moisture damage or excess moisture.
  6. Compliance with specification tolerances:
    - a. Record areas that are out of tolerance (greater than 1/4 inch in 8-0 feet deviation in plane).
- C. Notify Owner's Representative in writing of anticipated problems using waterproofing over substrate.

### 3.02 PREPARATION

- A. Clean substrate of projections and substances detrimental to work; comply with instructions of prime materials manufacturer.
- B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
- C. Fill voids, seal joints, and apply bond breakers as recommended by prime materials manufacturer.
- D. Prime substrate as recommended by prime materials manufacturer.

### **3.03 INSTALLATION - GENERAL**

- A. Comply with manufacturer's written installation recommendations, including preparation of substrate surfaces, detail coatings of joints and planar changes in substrate, and priming of substrates.
- B. Mix separately packaged components in accordance with manufacturer's written recommendations.

### **3.04 INSTALLATION - SHEET MEMBRANE WATERPROOFING**

- A. Apply waterproofing membrane material to substrates and adjoining surfaces indicated to receive membrane. Apply in accordance with manufacturer's recommendations to obtain thicknesses specified and using applicators and techniques best suited for slope and type of substrate to which applied.
  - 1. If two-coat application is required to obtain membrane thickness specified below, apply second coat only after initial coat has cured as recommended by manufacturer.
  - 2. Provide 60 mil (average) membrane thickness, with minimum 50 mil thickness.
- B. Install sheet membrane waterproofing material to substrates and adjoining surfaces indicated to receive membrane. Install in accordance with manufacturer's recommendations using applicators and techniques best suited for type of substrate to which applied.
- C. Install sheet-type flashings and joint covers where indicated and as recommended by prime materials manufacturer. Extend flashings onto perpendicular surfaces and other work penetrating substrate to not less than 6 inches beyond finished surface to be applied over waterproofing.
- D. Permit membrane to cure under conditions that will not contaminate or deteriorate waterproofing material. Block off traffic and protect membrane from physical damage.
- E. Install protection course on cured membrane (after testing, if required) without delay to minimize period of membrane exposure.
  - 1. On vertical surfaces comply with waterproofing manufacturer's recommendations for adhesion of protection course to membrane.
  - 2. In-Place Testing: Before completed membranes on horizontal surfaces are covered by protection course or other work, test for leaks with 2 inch depth of water maintained for 24 hours. Repair any leaks revealed by examination of substructure, and repeat test until no leakage is observed.
- F. Provide separation between waterproofing membrane and non-compatible substrates and materials in accordance with manufacturers published instructions.

### **3.05 INSTALLATION - UNDER-SLAB-ON-GRADE VAPOR RETARDER**

- A. General: Install vapor barrier in accordance with ASTM E1643. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible. Extend vapor and moisture barriers to extremities of areas to be protected from vapor transmission. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the [Owner's Representative] [Architect] or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself. Extend vapor and moisture barriers to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.
- B. Overlap joints 6" inches and seal with manufacturer's recommended seam tape. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape of type recommended by vapor retarder manufacturer to create an air-tight seal between penetrating objects and vapor retarder.
- C. Repair any tears or punctures in vapor and moisture barriers immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.
- D. Refer to Section 07 20 00 for installation of Under-slab-on-grade insulation.

### **3.06 PROTECTING AND CLEANING**

- A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

**SECTION 07 19 00**  
**WATER REPELLENTS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Water Repellent Coating Applied to All Exterior Exposed Masonry Unit Walls
- B. Related Sections:
  - 1. Section 04 20 00 (04200) - Masonry Units

**1.02 REFERENCES**

- A. FS SS-W-110 - Water Repellent, Colorless, Silicone Resin Base.

**1.03 SUBMITTALS**

- A. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) with the following supporting data:
  - 1. Submit product data including detailed test results of materials applied to surfaces similar to requirements of this Section.
  - 2. Submit manufacturer's instructions for methods and application procedures.
  - 3. Submit manufacturer's certification indicating water repellent coating conforms to or exceeds requirements stated herein.

**1.04 QUALITY ASSURANCE**

- A. The Contractors involved with work covered by this Section shall have had a minimum of five years experience using specified techniques for water repellent application.
- B. Tradesman must be competent and experienced and shall demonstrate reasonable care during performance of operations described in this Section.
- C. Tests and Approvals:
  - 1. Sample Area: Contractor shall apply a test area of wall surface from two to four square feet in size for inspection and approval by the Owner's Representative. Samples of adjacent materials shall be tested for possible reaction with the water repellent. Such samples shall be available for inspection by the Owner's Representative.
  - 2. If any part of this work shall be found defective (because of improper preparation of surfaces or application of coating) at any time before the final acceptance of the item, the Contractor shall, at his own expense, make good such defect to the satisfaction of the Owner's Representative.

**1.05 PROJECT CONDITIONS**

- A. Protection:
  - 1. Contractor shall provide, at all times, covered access to premises and necessary utilities, space for storage of material and equipment, etc.
  - 2. All activities shall be in compliance with local and governmental regulations and codes.
  - 3. The surface and atmospheric temperature should be at least 40 degrees F. and rising during application. Surfaces should be dry. Apply only in well ventilated areas. All caulking (sealants) should be applied a minimum of 24 hours prior to application, or as required by sealant manufacturer, whichever is greater, before application of water repellent.
  - 4. The Contractor shall require applicators to observe safety precautions as outlined on containers and labels. It is the responsibility of the Contractor to provide well ventilated areas for all workmen as well as to observe safety precautions as stipulated on labels and instructions of all materials used, and as required by governing authorities.

**PRODUCTS**

**2.01 MANUFACTURERS**

- A. Preferred Manufacturers:

1. None
- B. Approved Manufacturers:
  1. "Hydrozo Enviroseal Double 7"; BASF Building Systems (800-433-9517)
  2. "Sure Klean Weather Seal Siloxane WB"; ProSoCo, Inc. (800-255-4255)

## **EXECUTION**

### **3.01 PREPARATION**

- A. Verify surfaces to receive water repellent coatings are clean, free of efflorescence, oil, grease, or other foreign matter detrimental to application.
- B. Remove loose particles and foreign matter. Remove grease or oil with a solvent, effective alkaline cleaner, or detergent as instructed by coating manufacturer. Scrub surfaces with water.
- C. Allow surfaces to dry prior to application.
- D. Protect all surrounding areas as recommended by the manufacturer or as directed by the Owner's Representative.
  1. Windows: Windows shall be protected from contact with materials by masking with polyethylene or other approved techniques.
  2. All polished stone, metal, or non-masonry surfaces shall be protected from contact with the material by masking with polyethylene.
  3. Masonry surfaces must be in good repair. All new construction or repointed surfaces must be allowed to cure for a minimum of 28 days prior to application. Surfaces must be completely dry.

### **3.02 APPLICATION**

- A. Test each surface and/or material to be treated to ensure compatibility and desired water repellency results. The surface to be treated must be clean and free of all foreign matter and as dry as possible to ensure penetration of the water repellent.
- B. Apply material as supplied - do not dilute or alter material as packaged. Preferred method of application is with low pressure, airless diaphragm-type spray equipment or with a heavily saturated roller or brush. Apply in coverage rate as recommended by manufacturer for type of material.
- C. Protect adjacent surfaces not scheduled to receive coating. If applied on unscheduled surfaces, remove immediately, by manufacturer approved method.

## **END OF SECTION**

**SECTION 07 20 00**  
**THERMAL PROTECTION**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Batt Insulation
    - a. Unfaced
    - b. Faced
  - 2. Sound Attenuation Insulation
    - a. Mineral Fiber
    - b. Slag-Wool-Fiber/Rock-Wool-Fiber
  - 3. Foundation Wall and Under Slab Insulation
    - a. Extruded Polystyrene Foam
  - 4. Masonry Cavity Walls
    - a. Polyisocyanurate Board
  - 5. Vapor Retarder
  - 6. Insulation Baffles (Eave Ventilation Troughs)
- B. Related Sections:
  - 1. Section 04 20 00 (04200) - Unit Masonry
  - 2. Section 05 40 00 (05400) - Cold-Formed Metal Framing
  - 3. Section 06 10 00 (06100) - Rough Carpentry
  - 4. Section 06 20 00 (06200) - Finish Carpentry
  - 5. Section 07 10 00 (07100) - Dampproofing and Waterproofing
  - 6. Section 07 24 00 (07240) - Exterior Insulation and Finish Systems (EIFS)
  - 7. Section 07 24 19 (07241) - Water Drainage Exterior Insulation and Finish Systems (EIFS)
  - 8. Section 07 27 00 (07270) - Air Barriers
  - 9. Section 07 46 46 (07460) - Fiber-Cement Siding
  - 10. Section 07 42 13 (07410) - Metal Wall Panels
  - 11. Section 07 62 00 (07620) - Sheet Metal Flashing and Trim
  - 12. Section 07 84 00 (07840) - Firestopping
  - 13. Section 07 81 29 (07845) - Ceramic Fiber Fireproofing
  - 14. Section 09 21 16 (09255) - Gypsum Board Assemblies

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. C578 "Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation"
  - 2. C665 "Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing"
  - 3. D4397 "Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications"
  - 4. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
  - 5. E96 "Standard Test Methods for Water Vapor Transmission of Materials"
  - 6. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
  - 7. E136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C"
  - 8. E1677 "Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls"
  - 9. E1745 "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs"
- B. Code of Federal Regulations (CFR) Publications:
  - 1. 40 CFR 763, "Asbestos: Appendix A - Transmission Electron Microscopy Analytical Methods"

- C. Underwriter's Laboratories, Inc. (UL) Standards  
1. "Fire Resistance Directory"

### **1.03 DEFINITIONS**

- A. Thermal Resistivity: Where thermal resistivity properties of insulation materials are designated by r-values, they represent the rate of heat flow through a homogeneous material exactly 1" thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

### **1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
- C. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values (aged values for plastic insulations), densities, compression strengths, fire performance characteristics, perm ratings, water absorption ratings and similar properties.

### **1.05 QUALITY ASSURANCE**

- A. Fire Test Response Characteristics: Provide insulation materials which are identical to those whose fire-test-response characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.
1. Surface Burning Characteristics: ASTM E84
  2. Fire Resistance Ratings: ASTM E119
  3. Combustion Characteristics: ASTM E136
- B. Asbestos Content of Inorganic Insulations: provide insulations composed of mineral fibers or mineral ores which contain no asbestos of any type of mixture of types occurring naturally as impurities as determined by polarized light microscopy test per Appendix A of 40 CFR 763.
- C. All insulation in roof and wall assemblies shall be approved for use without an additional thermal barrier in accordance with Local Building Codes.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver insulation in original labeled bundles.
- B. General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage, and protection during installation.
- C. Protection for Plastic Insulation:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time.
  3. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

### **1.07 PROJECT CONDITIONS**

- A. The Installer must examine the substrate and the conditions under which insulation work is to be performed and notify the Architect in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

- B. Weather Conditions: Proceed with work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with requirements and the manufacturer's recommendations.
- C. Do not apply insulation to damp, frozen, dirty, dusty, or surfaces unacceptable to manufacturer.
- D. Coordinate this work with all trades and protect it after installation.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Unfaced Glass Fiber Batt Insulation
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "ComfortTherm"; Johns-Manville (800-654-3103)
    - b. "EcoTouch"; Owens-Corning (800-438-7465)
    - c. "Sustainable Insulation"; CertainTeed Corp, a subsidiary of Saint-Gobain (800-233-8990)
    - d. "EcoBatt"; Knauf Insulation GmbH (800-825-4434)
    - e. No Substitution.
  - 3. Approved Manufacturers:
    - a. Owens-Corning (800-438-7465)
    - b. Johns-Manville (800-654-3103)
    - c. CertainTeed Corp, a subsidiary of Saint-Gobain (800-233-8990)
    - d. Knauf Insulation GmbH (800-825-4434)
    - e. Approved Substitution
- B. Faced Glass Fiber Blanket Insulation:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "ComfortTherm"; Johns-Manville (800-654-3103)
    - b. "EcoTouch"; Owens-Corning (800-438-7465)
    - c. "Sustainable Insulation"; CertainTeed Corp, a subsidiary of Saint-Gobain (800-233-8990)
    - d. "EcoBatt"; Knauf Insulation GmbH (800-825-4434)
    - e. No Substitution.
  - 3. Approved Manufacturers:
    - a. Owens-Corning (800-438-7465)
    - b. Johns-Manville (800-654-3103)
    - c. CertainTeed Corp, a subsidiary of Saint-Gobain. (800-233-8990)
    - d. Knauf Insulation GmbH (800-825-4434)
    - e. Approved Substitution
- C. Mineral Fiber Sound-Attenuation Insulation:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Thermafiber SAFB"; Thermafiber (888-834-2371)
- D. Slag-Wool-Fiber/Rock-Wool-Fiber Sound-Attenuation Insulation:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. Thermafiber (888-834-2371)
    - b. Fibrex Insulations Inc. (800-265-7514)
    - c. Owens-Corning (800-438-7465)



- E. Extruded Polystyrene Foam Board Insulation - Foundation Walls and Under Slab.
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Styrofoam Square Edge"; Dow Chemical Company (800-441-4369)
    - b. "Foamular 250"; Owens-Corning (800-438-7465)
- F. Polyisocyanurate Board Insulation - Masonry Cavity Walls
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "THERMAX (ci) Exterior Insulation"; Dow Chemical Company (800-441-4369)
    - b. "TSX-8500"; Rmax Operating, LLC (972-387-4500)
    - c. "Hunter Xci Foil"; Hunter Panels (888-746-1114)
- G. Vapor Retarders - Walls and Ceilings:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturer:
    - a. "MemBrain Smart Vapor Retarder"; CertainTeed Corp, a subsidiary of Saint-Gobain (800-233-8990).
    - b. No substitution.

## 2.02 INSULATING MATERIALS

- A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.
- B. Unfaced Glass Fiber Batt Insulation:
  - 1. ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics. [Product shall be free of formaldehyde].
- C. Faced Mineral-Fiber Blanket Insulation:
  - 1. ASTM C665, Type Type II, Class C, Category 1; consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics. [Product shall be free of formaldehyde].
  - 2. Mineral-Fiber Type: Fibers manufactured from glass.
  - 3. Flanged Units: Provide blankets fabricated with facing incorporating 5-inch - wide flanges along edges for attachment to framing members, or Polyethelene Wrapped Batts with stapling flaps.

## 2.03 TWO TYPES OF SOUND ATTENUATION INSULATION FOLLOW IN PARAGRAPHS BELOW. DELETE EITHER MINERAL FIBER OR SLAG-WOOL-FIBER. ROCK-WOOL FIBER INSULATION TYPE.

- A. Mineral Fiber Sound-Attenuation Insulation:
  - 1. Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C665 for Type I (blankets without membrane facing), passing ASTM E136 for combustion characteristics.
  - 2. Mineral-Fiber Type: Slag Wool-Fiber/Rock-Wool-Fiber.
- B. Slag-Wool-Fiber/Rock-Wool-Fiber Sound-Attenuation Insulation:
  - 1. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
  - 2. Faced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.

- C. Extruded Polystyrene Board Insulation - Foundation Walls and Under Slab:
  - 1. Rigid, cellular polystyrene thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C578 for Type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg. F., respectively; and as follows:
    - a. Type IV, 1.6 lb./cu. ft. min. density, unless otherwise indicated.
- D. Polyisocyanurate Board Insulation - Masonry Cavity Walls
  - 1. Aluminum-foil-faced, glass-fiber-reinforced, rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C1289, Type I, Class 2. UL Class A.
  - 2. Surface Burning Characteristics in accordance with ASTM E84:
    - a. Flame Spread: 25
    - b. Smoke Developed: <450
  - 3. Material shall comply with International Building Code (IBC) Section 2603 for use in exterior walls without an additional thermal barrier.
- E. Vapor Retarders - Walls and Ceilings:
  - 1. Approved Manufacturer:
    - a. "MemBrain Smart Vapor Retarder"; CertainTeed Corp., a subsidiary of Saint-Gobain (800-233-8990).
    - b. No substitution.
  - 2. Polyimide film vapor retarder for use with unfaced, vapor permeable glass fiber and mineral wool insulation in wall and ceiling cavities. Material has a permeance of 1 perm or less when tested to ASTM E 86, dry cup method and increases to greater than 10 perms using the wet cup method.
    - a. Water Vapor Permeance:
      - 1) ASTM E86, dry cup method: 1.0 perms.
      - 2) ASTM E86, wet cup method: 10.0 perms.
  - 3. Vapor-Retarder Accessories:
    - a. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
- F. Vapor Retarders - Walls and Ceilings:
  - 1. Polyethylene Vapor Retarder: ASTM D4397, with maximum performance rating of 0.13 perm provide in lengths required for least number of seams.
    - a. Walls: 6 mils thick
  - 2. Where required by local codes or ordinances, provide fire-retardant, reinforced-polyethylene vapor retarders. Flame spread and smoke developed indicates of not more than 5 and 75, respectively.
  - 3. Vapor-Retarder Accessories:
    - a. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
    - b. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- G. Eave Ventilation Troughs:
  - 1. Preformed rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

## EXECUTION

### 3.01 EXAMINATION

- A. Require Installer to examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified. Obtain Installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

1. Verify adjacent materials are dry and ready to receive insulation.
2. Verify mechanical and electrical services within insulated spaces have been installed and tested.
3. Verify substrate surface is flat, free of honeycomb, fins, irregularities, and materials that will impede adhesive bond.

### **3.02 PREPARATION**

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections which might puncture vapor retarders.

### **3.03 INSTALLATION, GENERAL**

- A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specified recommendations before proceeding with work.
  1. Verify insulation boards are unbroken and free of damage.
- B. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
- C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.
- D. Trim insulation neatly to fit spaces. Use boards free of damage.
- E. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
- F. Install all insulation in accordance with manufacturer's specifications.
- G. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

### **3.04 INSTALLATION - PERIMETER AND UNDER-SLAB INSULATION**

- A. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.
- B. Protect top surface of horizontal insulation (from damage during concrete work) by application of protection board.

### **3.05 INSTALLATION - GENERAL BUILDING INSULATION**

- A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Set vapor retarder faced units with vapor retarder to warm side of construction, except as otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
  1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure air-tight 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 cavities formed by framing members. Where 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.

### **3.06 INSTALLATION - CAVITY-WALL INSULATION**

- A. Refer to Section 04 20 00 - Unit Masonry.

### **3.07 INSTALLATION - VAPOR RETARDERS**

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16" o.c.
- C. Seal overlapping joints in vapor retarders with adhesives per vapor retarder manufacturer's printed directions. Seal butt joints and fastener penetrations with tape of type recommended by vapor retarder manufacturer. Locate all joints over framing members or other solid substrates. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape of type recommended by vapor retarder manufacturer to create an air-tight seal between penetrating objects and vapor retarder.
- E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### **3.08 PROTECTION**

- A. General: Protect installed insulation and vapor retarders from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

### **3.09 SCHEDULES**

### **3.10 SCHEDULES**

- A. Attic Insulation: [R=30], [kraft-faced] [unfaced], [batt fiberglass] [blown-in] insulation.
- B. Exterior Wall Insulation: [R=19] [kraft-faced] [unfaced] [faced], batt fiberglass insulation. Completely fill void to thickness of wall to STC requirements required.
- C. Acoustic Insulation in Walls: [Unfaced, batt fiberglass] [Mineral Fiber Sound-Attenuation], batt fiberglass insulation friction fit, completely fill void to thickness of wall to STC requirements required.
- D. Acoustic Insulation in Floor/Ceiling assemblies: Faced or Unfaced batt fiberglass insulation to meet [STC-50].
- E. Rigid Board Insulation in Foundation Perimeter: [R=12.5].

**END OF SECTION**

## SECTION 07 24 19

### WATER DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEMS

#### GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Water Management Exterior Insulation and Finish Coating Systems Application with secondary air/moisture barrier system as described and specified herein.
- B. Related Sections:
  - 1. Section 05 40 00 - Cold-Formed Metal Framing
  - 2. Section 06 10 00 - Rough Carpentry
  - 3. Section 07 20 00 - Thermal Protection
  - 4. Section 07 24 23 - Direct Applied Exterior Finish Systems
  - 5. Section 07 62 00 - Sheet Metal Flashing and Trim
  - 6. Section 07 92 00 - Joint Sealants

##### 1.02 REFERENCES

- A. ASTM International Publications:
  - 1. B117 "Standard Practice for Operating Salt Spray (Fog) Apparatus"
  - 2. C150 "Standard Specification for Portland Cement"
  - 3. C1063 "Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster"
  - 4. C1177/C1177M "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing"
  - 5. C1382 Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints"
    - a. C1397 "Standard Practice for Application of Class PB Exterior Insulation and Finish Systems"
    - b. C1481 "Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS)"
  - 6. D578 "Standard Specification for Glass Fiber Strands"
  - 7. D2247 "Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity"
  - 8. D3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber"
    - a. D3274 "Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation"
    - b. D1784 "Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds"
    - c. D4258 "Standard Practice for Surface Cleaning Concrete for Coating"
    - d. D4261 "Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating"
    - e. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
    - f. E331 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference"
    - g. E2098 "Standard Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution"
    - h. E2110 "Standard Terminology for Exterior Insulation and Finish Systems (EIFS)"
    - i. E2273 "Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies"
    - j. E2430 "Standard Specification For Expanded Polystyrene ("EPS") Thermal Insulation Boards For Use In Exterior Insulation and Finish Systems ("EIFS")"
    - k. E2485 "Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings "

- l. E2486 "Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)"
  - m. E2568 "Standard Specification for PB Exterior Insulation and Finish Systems"
  - n. E2570 "Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage"
- B. Gypsum Association (GA) Publications:
- 1. GA-253 "Recommended Specifications for the Application of Gypsum Sheathing"
- C. International Code Council (ICC)
- D. ICC Evaluation Service Reports:
- 1. AC235 "Acceptance Criteria for EIFS Clad Drainage Wall Assemblies"
  - 2. National Fire Protection Association (NFPA) Publications:
  - 3. 268 "Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source"
  - 4. 285 "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components"

### 1.03 DEFINITIONS

- A. Class PB Exterior Insulation and Finish System (EIFS), per ASTM E2110 are systems applied over insulation board, in which the base coat ranges from not less than 1 /16 in. (1.6 mm) to 1/4 in. (6.4 mm) in dry thickness, depending upon the number of nonmetallic reinforcing mesh layers encapsulated in the base coat. The base coat is then covered with a finish coat of various thickness in a variety of textures and colors.
- B. Water-Drainage Exterior Insulation and Finish System (EIFS): EIFS with a means that allows moisture entering into an EIFS assembly to drain to the exterior.

### 1.04 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Polymer-based protective coating 100% pure acrylic resin based materials. No materials using non-acrylic resins in their formulas will be accepted.
  - 2. Exterior insulation and finish system refers to a non-structural exterior wall assembly composed of the following components:
    - a. An approved substrate.
    - b. An approved air/water-resistive barrier compatible with substrate and with adhesively attached insulation system.
    - c. UV treated PVC perforated Drainage track.
    - d. Thermal insulation board adhesively attached to the air/water resistive barrier.
    - e. Polyethylene, self-adhering flashing tape or fluid applied / reinforced flexible flashing compatible with substrate coatings.
    - f. A reinforced base coat applied to the insulation board.
    - g. A 100% acrylic based textured coating applied over the reinforced base coat.
    - h. Approved sealants are required at all dissimilar materials as well as EIFS to EIFS expansion and control joints, and are specified in Section 07 92 00.
- B. Performance Requirements:
  - 1. General: Provide systems that comply with the following performance requirements:
    - a. Bond Integrity: Free from bond failure within EIFS system components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
    - b. Weathertightness: Resistant to water penetration from exterior into system and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of system and assemblies behind it, including substrates, supporting wall construction, and interior finish, and including a means that allows water entering into an EIFS assembly to drain to the exterior.
    - c. Water Penetration: No water penetration when tested in accordance with ASTM E331.

- d. Moisture Resistance: No deleterious effects after 14 days when tested in accordance with ASTM D 2247.
- e. Drainage: Greater than 90% drainage efficiency when tested in accordance with ASTM E2273.
- f. Salt Spray Resistance: No deleterious effects after 300 hours when tested in accordance with ASTM B117.
- g. Freeze/Thaw: No deleterious effects when tested in accordance with ASTM E2485.
- h. Mildew Resistance: No growth supported during 28 day exposure period when tested in accordance with ASTM D3273 and evaluated according to ASTM D3274.
- i. Impact Resistance:
  - 1) ASTM E2486 minimum values without cracking:
    - (a) Standard Impact Resistance - Adhesive/Base Coat - 25-49 in/lb
    - (b) Medium Impact Resistance - Adhesive/Base Coat - 50-89 in/lb
    - (c) High Impact Resistance - Adhesive/Base Coat - 90-150 in/lb
    - (d) Ultra-High Impact Resistance - Adhesive/Base Coat - >150 in/lb
  - 2) From grade to 2nd floor, a minimum 90-150 inch/pounds impact system is required.
  - 3) From 2nd floor up to a minimum 50-89 in/lb impact system is required.
  - 4) High traffic areas: provide 150 in/lb or greater impact system.

#### 1.05 SUBMITTALS

- A. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) with the following supporting data:
  - 1. Product Data: Submit technical product data, test reports, installation instructions and recommendations from manufacturer, including data that materials comply with requirements.
  - 2. Submit one 1 ft. x 1 ft. sample of the wall system for each finish, color, and texture selected using same tools and techniques as for the actual project.
  - 3. Shop Drawings: Show installation of system including plans, elevations, sections, details of components, joint locations and configurations within system and between system and construction penetrating it, termination details, and attachments to construction behind system which are project-specific.
  - 4. Certifications:
    - a. Manufacturer's written certification of installer as qualified to install manufacturer's system using trained workers.
    - b. Certification that materials meet or exceed requirements.
    - c. Provide manufacturers applicable code compliance report stating that the EIFS as installed has been tested per local Code requirements and does not affect the fire rating of the exterior wall assembly.
- B. Field-Constructed Mock-Up: Prior to installation of exterior insulation and finish systems, erect mock-ups for each form of wall construction, including typical caulked joints and/or rustication type joints, etc., and finish required to verify selections made under sample submittals. Build mock-ups to comply with the following requirements, using materials indicated for final work:
  - 1. Locate mock-ups on site in location and of size indicated or, if not indicated, as directed by the Owner's Representative.
  - 2. For Specialty Metallic Finish Coatings, mock-up shall include an area not less than 5 feet x 5 feet with a full and complete application of the Metallic Pearlescent Coating over primer over smooth textured finish panel area and a simulated cornice band area as specified herein.
  - 3. Obtain the [Architect][Owner's Representative] acceptance of mock-up's visual qualities before start of final work.
- C. Closeout Submittals:
  - 1. Affidavits:

- a. Where mandated by applicable building codes, provide affidavits from EIFS and sealant applicators confirming full compliance to all manufacturers' application requirements.



## SECTION 07 27 00

### AIR BARRIERS

#### SUMMARY

##### 1.01 SECTION INCLUDES:

- A. Fluid-Applied Membrane Air Barrier
  - 1. Vapor Permeable
  - 2. Air-Infiltration Barrier
- B. Related Sections:
  - 1. Section 04 20 00 - Unit Masonry
  - 2. Section 05 40 00 - Cold-Formed Metal Framing
  - 3. Section 06 10 00 - Rough Carpentry
  - 4. Section 07 10 00 - Dampproofing and Waterproofing
  - 5. Section 07 20 00 - Thermal Protection
  - 6. Section 07 24 19 - Water Drainage Exterior Insulation and Finish Systems (EIFS)
  - 7. Section 07 62 00 - Sheet Metal Flashing and Trim
  - 8. Section 07 92 00 - Joint Sealants
  - 9. Section 09 21 16 - Gypsum Board Assemblies

##### 1.02 REFERENCES

- A. ASTM International Publications:
  - 1. C578 "Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation"
  - 2. C665 "Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing"
  - 3. C1177 "Specification for Glass Mat Gypsum Substrate for Use as Sheathing"
  - 4. C1193 "Standard Guide for Use of Joint Sealants"
  - 5. D522 "Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings"
  - 6. D3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber"
  - 7. D4258 "Standard Practice for Surface Cleaning Concrete for Coating"
  - 8. D4397 "Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications"
  - 9. D4541 "Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers"
  - 10. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
  - 11. E96 "Standard Test Methods for Water Vapor Transmission of Materials"
  - 12. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
  - 13. E136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C"
  - 14. E283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen"
  - 15. E331 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference"
  - 16. E1186 "Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems"
  - 17. E1233 "Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential"
  - 18. E1677 "Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls"
  - 19. E1745 "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs"
  - 20. E1827 "Standard Test Methods for Determining Air tightness of Buildings Using an Orifice Blower Door"
  - 21. E2178 "Test Method for Air Permeance of Building Materials"

22. E2247 "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property"
23. E2357 "Standard Test Method for Determining Air Leakage of Air Barrier Assemblies"
- B. Gypsum Association (GA) Publications:
  1. GA-600 "Fire Resistance Design Manual"
  2. GA-253 "Recommended Specifications for the Application of Gypsum Sheathing"
  3. GA-254 "Fire-Resistant Gypsum Sheathing"
- C. The Engineered Wood Association (APA) Publications:
  1. Form No. E30, "APA Engineered Wood Construction Guide"
- D. American Association of Textile Chemists and Colorists (AATCC)
  1. Test Method 127 "Water Resistance: Hydrostatic Pressure Test"
- E. American Association of Textile Chemists and Colorists (AATCC) Publications:
  1. Test Method 127 "Water Resistance: Hydrostatic Pressure Test"
  2. ICC Evaluation Service Reports:
  3. ES AC212 "ICC Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing"
- F. Technical Association of the Pulp and Paper Industry (TAPPI) Publications:
  1. Test Method T-410; Grammage of Paper and Paperboard (Weight per Unit Area)
  2. Test Method T-460; Air Resistance of Paper (Gurley Hill Method)

### **1.03 PERFORMANCE REQUIREMENTS**

- A. General: Function as a continuous vapor-permeable air barrier system and as a liquid-water drainage plane flashed to discharge condensation or water penetration to the exterior.
- B. Deflection Criteria: Maximum allowable deflection normal to the plane of the wall: L/240
- C. Wind Load: Conform to local code requirements.

### **1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  1. Include manufacturer's written technical data and installation instructions.
  2. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, perm ratings, and similar properties.
- C. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.
- D. Air-Infiltration Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

### **1.05 QUALITY ASSURANCE**

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
  1. Installer shall be trained and certified for installation by manufacturer.
- B. Source Limitations: Provide air barrier and accessory materials produced by single manufacturer.
- C. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly for approval by [Architect] [Owner's Representative], 150 sq. ft., incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  2. Contact manufacturer's designated representative prior to air infiltration barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.
- D. Preinstallation Conference: Conduct conference at Project site.
1. Attendees shall include Contractor, Architect, Engineer, Consultant, Installer, Owner's Representative, and [Air Infiltration Barrier Manufacturer's Designated Representative][and][Fluid-Applied Membrane Air Barrier Manufacturer's Designated Representative]
  2. Include installers of other construction connecting to air barrier, including roofing, waterproofing, masonry, sealants, windows, aluminum storefront, and door frames.
  3. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
- B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Store rolls according to manufacturer's written instructions.
- D. Protect stored materials from direct sunlight, freezing temperatures, and temperatures in excess of 90 degrees F.

#### **1.07 PROJECT CONDITIONS**

- A. The Installer must examine the substrate and the conditions under which insulation work is to be performed and notify the Architect in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Weather Conditions: Proceed with work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with requirements and the manufacturer's recommendations.
- C. Do not apply air barrier and components to damp, frozen, dirty, dusty, or surfaces unacceptable to manufacturer.
  1. Maintain ambient and surface temperatures above 40 degrees F. during application and drying period, minimum 24 hours after application of air and moisture barrier
  2. Provide supplementary heat for installation in temperatures less than 40 degrees F. or if surface temperature is likely to fall below 40 degrees F.
- D. Coordinate this work with all trades and protect it after installation.

#### **1.08 SEQUENCING**

- A. Coordinate installation of [foundation waterproofing], roofing membrane, windows, doors and other wall penetrations to provide a continuous air barrier.
- B. Provide sill flashing to direct water to the exterior before windows and doors are installed.
- C. Install window and door head flashing immediately after windows and doors are installed.
- D. Install diverter flashings wherever water can enter the assembly to direct water to the exterior.

#### **1.09 SPECIAL WARRANTY**

- A. DuPont Tyvek Non-Fluid Applied System: Special weather-barrier manufacturer's warranty for air infiltration barrier for a period of ten (10) years from date of final air infiltration barrier installation.
  1. Product and Labor Limited Warranty: Manufacturer warrants that products will meet or exceed the water holdout performance properties (pursuant to the Hydrostatic Head Test

- in accordance with AATCC 127 and pursuant to the Gurley Hill test for air holdout in accordance with TAPPI T-460).
2. Project must use specified DuPont Tyvek Wrap Products and DuPont Flashing Products as specified in Section 07 62 00 "Sheet Metal Flashing and Trim".
  3. Warranty shall cover, at no cost to the Owner, all labor and materials required to repair wall systems to correct any problem that arises solely out of the failure of the DuPont Products.
  4. Pre-installation meetings and jobsite observations by air infiltration barrier manufacturer for warranty is required prior to assembly installation.
    - a. Project must be registered by Contractor before start of installation. Registration process will be covered during the pre-installation meeting with a Qualified DuPont Tyvek Specialist.
  5. Product Limited Warranty: Manufacturer warrants that products will meet or exceed the water holdout performance properties (pursuant to the Hydrostatic Head Test in accordance with AATCC 127 and pursuant to the Gurley Hill test for air holdout in accordance with TAPPI T-460).
  6. Warranty shall cover, at no cost to the Owner, all materials required to repair wall systems to correct any problem that arises solely out of the failure of the DuPont Products. Certified Installer is required.
  7. Pre-installation meetings and jobsite observations by Fluid applied air barrier system manufacturer for warranty is required prior to assembly installation.
    - a. Project must be registered by Contractor before start of installation. Registration process will be covered during the pre-installation meeting with a Qualified DuPont Tyvek Specialist.

## PRODUCTS

### 2.01 FLUID-APPLIED MEMBRANE AIR BARRIER - ABOVE GRADE

- A. Preferred Manufacturers:
  1. None
- B. Approved Manufacturers
  1. "DuPont Tyvek Fluid Applied WB System"; DuPont Company (800-448-9835)
    - a. Joint Treatment: "Tyvek Fluid Applied Flashing and Joint Compound, Trowel Grade"
    - b. Membrane Air Barrier Coating: "DuPont Tyvek Fluid Applied System"
    - c. Flashing System: "Tyvek FlexWrap" and "Tyvek StraightFlash"
    - d. Sealant for use with System: "Dupont Sealant for Tyvek Fluid Applied System"
  2. "Sto Guard"; Sto Corporation (800-221-2397)
    - a. Joint Treatment: "Sto Gold Coat with StoGuard Fabric"
    - b. Membrane Air Barrier Coating: "Sto Gold Coat"
    - c. Flashing System: "Sto Gold Coat with StoGuard Fabric"
  3. "R GUARD Spray Wrap"; PROSOCO (800-255-4244)
    - a. Joint Treatment: "R-GUARD Joint and Seam Filler"
    - b. Membrane Air Barrier Coating: "R-GUARD Spray Wrap"
    - c. Flashing System: "R-GUARD FastFlash"
  4. "Perm-A-Barrier VP"; Grace Construction Products (866-333-3726)
    - a. Joint Treatment: "Bituthene Liquid Membrane"
    - b. Membrane Air Barrier Coating: "Perm-A-Barrier VP"
    - c. Flashing System: "Perm-A-Barrier Wall Flashing"
  5. "Backstop NT"; Dryvit Systems, Inc. (800-556-7752)
    - a. Joint Treatment: "Dryvit Grid Tape and Surface Conditioner / Backstop NT Texture"
    - b. Membrane Air Barrier Coating: "Backstop NT"
    - c. Flashing System: "AquaFlash Liquid with AquaFlash Tape"
- C. Fluid-Applied Membrane Air Barrier: Acrylic-based weather resistive, vapor permeable coating over [exterior sheathing] [concrete masonry unit] walls above grade.
- D. Performance Characteristics:

1. Maximum air permeability: 0.004 cfm/SF under a pressure differential of 0.3 in water (1.57 psf) when tested in accordance with ASTM E2178.
  2. Aging/Water Penetration Resistance
    - a. Method: AATCC 127 (Water Column) and ASTM E331
    - b. Criteria: Resist 21.6 inches water for 5 hours before and after aging
    - c. Results: No water penetration before and after aging
  3. Structural Loading/Water Penetration Testing
    - a. Method: ASTM E1233 / ASTM E331
    - b. Criteria: No water at exterior plane of sheathing after 10 cycles @ 80% design load and 75 minutes water spray at 6.24 psf differential
    - c. Results: No water penetration
  4. Cyclic Pressure/Water Penetration Testing
    - a. Method: ASTM E283 / ASTM E331
    - b. Criteria: No water penetration or evidence of elevated moisture levels in plywood sheathing after 10 cycles of conditioning at 299 Pa positive and negative pressure followed by 75 minutes water spray at 6.24 psf pressure differential with water spray rate of 5 gal/ft<sup>2</sup>·hr.
    - c. Results: No water penetration, no elevated moisture levels
  5. Water Resistance Testing
    - a. Method: ASTM D2247
    - b. Results: No deleterious effects after 14 day exposure
  6. Resistance to Mold Growth
    - a. Method: ASTM D3273
    - b. Results: No mold growth after 28 days
  7. Water Vapor Transmission
    - a. Method: ASTM E96 Method B (Water Method)
    - b. Results: Meets criteria
  8. Flexibility
    - a. Method: ASTM D522
    - b. Criteria: No cracking or delamination using 1/8" mandrel at 14°F before and after aging
    - c. Results: No cracking or delamination before and after aging
  9. Surface Burning
    - a. Method: ASTM E84
    - b. Criteria:
      - 1) Flame Spread: <25
      - 2) Smoke Developed: <450
  10. Fire Resistance
    - a. Method: ASTM E119
    - b. Criteria: Meets criteria for 1-hour fire resistance rating when installed over 1 hour fire resistance rated sheathing
- E. Accessory Materials:
1. Provide accessory materials as recommended by the membrane air barrier manufacturer as recommended for complete installation, including but not limited to joint reinforcing strips, adhesives, tapes, primers, and sealants.

## **2.02 AIR-INFILTRATION BARRIERS:**

- A. Preferred Manufacturers:
  1. None
- B. Approved Manufacturers:
  1. "Tyvek HomeWrap"; DuPont Company (800-448-9835)
  2. "Classic Wrap"; Pactiv Building Products (888-828-2850)
  3. "WallShield" by Proctor Group Ltd., distributed by VaproShield™ L.L.C., (866-731-7663)
  4. "Tytar HouseWrap"; Fiberweb, Inc. (800-284-2780)

5. "Tyvek CommercialWrap"; DuPont Company (800-448-9835)
  6. "Typar StormWrap"; Fiberweb, Inc. (800-284-2780)
  7. "Tyvek StuccoWrap or DrainWrap"; DuPont Company (800-448-9835)
- C. Air-Infiltration Barrier
1. Air retarder complying with ASTM E1677; made from polyolefins; either cross-laminated films, woven strands, or spunbonded fibers; coated or uncoated; with or without perforations to transmit water vapor but not liquid water; and as follows:
    - a. Minimum Thickness: 3 mils.
    - b. Minimum Water-Vapor Transmission: 28 perms when tested according to ASTM E96, Procedure B.
    - c. Maximum air permeability: 0.004 cfm/SF under a pressure differential of 0.3 in water (1.57 psf) when tested in accordance with ASTM E2178.
    - d. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
    - e. Maximum Flame Spread: 25 per ASTM E84.
    - f. Minimum Allowable Exposure Time: 3 months.
    - g. Membrane shall be free from holes and breaks other than those created by fasteners and construction system due to attachment.
  2. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap.
  3. Fasteners:
    - a. Recommended Fasteners for Wood Framed construction:
      - 1) Nails with large heads or plastic washers.
    - b. Recommended Fasteners for Steel Framed Construction:
      - 1) 1-5/8" Rust resistant screws with 2" diameter plastic cap, by DuPont Company, or approved substitution by other listed air-infiltration barrier manufacturer.
    - c. Recommended Fastening to Masonry:
      - 1) Polyurethane or elastomeric adhesives.
- D. Accessories:
1. Nails and Staples: Steel wire, galvanized, type and size to suit application.
  2. Tape: Polyethylene or Polyester, self-adhering type, 2 inches wide.
  3. Adhesives: As recommended in manufacturer's written instructions.

## EXECUTION

### 3.01 EXAMINATION

- A. Require Installer to examine substrates and conditions under which air barrier work is to be performed. A satisfactory substrate is one that complies with requirements of the sections in which substrate and related work is specified. Obtain Installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.
1. Verify adjacent materials are dry, free of contaminants and ready to receive barrier system.
  2. Verify substrate surface is flat, free of honeycomb, fins, irregularities, and materials that will impede adhesive bond.
  3. Verify that concrete surfaces are dry and have cured for minimum time recommended by membrane air barrier manufacturer.

### 3.02 PREPARATION

- A. Clean substrates of substances harmful to membranes, including removal of projections which might puncture vapor retarders.
- B. Inspect sheathing application for compliance with applicable requirement:
1. Exterior gypsum sheathing: GA-253
  2. Glass mat faced gypsum sheathing: Consult manufacturer's published recommendations.
  3. Remove surface contaminants and replace damaged sheathing.

4. Spot surface defects in sheathing with joint treatment as recommended by membrane manufacturer.
5. Repair cracks, spalls, or other damage in concrete or concrete masonry surfaces

### 3.03 INSTALLATION, GENERAL

- A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specified recommendations before proceeding with work.

### 3.04 INSTALLATION - FLUID-APPLIED MEMBRANE AIR BARRIER

- A. Install Fluid-Applied Membrane Air Barrier in strict accordance with manufacturers written instructions.
  1. Coordinate work with other trades to ensure air barrier continuity with connections at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.
- B. Prepare and treat joints as recommended by manufacturer and in accordance with ASTM C1193.
  1. Gypsum Sheathing: All joints greater than 1/16 inch shall be filled with joint sealer as recommended by membrane air barrier manufacturer.
    - a. No joint treatment required for joints up to 1/16 inch.
    - b. Joints 1/16 to 1/4 inch: Fluid-applied joint compound applied to form a 1 inch width on each side of sheathing joint; smooth joint compound across sheathing joint. Thickness shall be 15 to 25 mils.
    - c. Joints 1/16 to 1/2 inch: Apply joint tape to bridge both sides of joint equally. Apply fluid-applied joint compound and trowel smooth embedding joint compound uniformly into joint tape to form a 1 inch width on each side of sheathing joint at a consistent thickness of 15 to 25 mils.
    - d. Joints 1/2 to 1 inch: Apply sheet flashing primer above and below sheathing joint. Center sheet flashing over sheathing joint and press firmly in place per manufacturer's recommendations.
  2. Non-movement joints in masonry and transitions to columns and beams:
    - a. Joints 1/4 inch wide or less: Apply fluid-applied joint compound a minimum of 2 inches wide by 60 mils thick to each side of joint or crack.
  3. Concrete and Masonry:
    - a. Inspect concrete and concrete masonry surfaces for:
      - 1) Contamination - algae, dirt, dust, efflorescence, form oil, fungus, grease, mildew or other foreign substances.
      - 2) Surface deficiencies - weak, friable, chalkiness, laitance, bugholes, and spalls.
      - 3) Cracks, Contractor shall measure crack width and record location of cracks.
      - 4) Damage or deterioration.
      - 5) Moisture content and moisture damage, contractor to determine if the surface is dry enough to receive the air barrier in accordance with manufacturer's recommendations. Record any areas of moisture damage or excess moisture.
    - b. Flush masonry mortar joints shall be completely filled with mortar.
    - c. Remove dust in accordance with ASTM D4258 before applying coatings.
- C. Install transition strips and other accessory materials according to membrane air barrier manufacturer's instructions to form a continuous seal with all adjacent materials.
- D. Corners: Apply fluid-applied joint compound, in thickness as recommended by manufacturer, to outside and inside corners. Joint compound shall extend 2 inches from corner for full height of corner, or apply primer to outside and inside corners, extend 2 inches on each side of corner. Center sheet flashing over corner and press firmly in place per manufacturer's recommendations.

- E. Membrane system shall be extended into all wall openings such as doors and windows to form a complete seal at perimeters.
  - 1. Refer to Section 07 62 00 "Sheet Metal Flashing and Trim" for flashings at Wall Openings such as windows and doors.
- F. All through wall flashings shall be sealed at top with counterflashings as recommended by membrane air barrier manufacturer.
- G. Repair all damaged locations including punctures, voids, deficient seams, fishmouths and blisters.

### **3.05 INSTALLATION - AIR-INFILTRATION BARRIER**

- A. Cover sheathing with air-infiltration barrier as follows:
  - 1. Apply air-infiltration barrier to comply with air-infiltration barrier manufacturer's written instructions and as coordinated with siding manufacturer's recommendations.
- B. Install Air Infiltration Barrier over exterior side of exterior wall sheathing.
  - 1. Install Air Infiltration Barrier after sheathing is installed and before windows and doors are installed. Install lower level barrier prior to upper layers to ensure proper shingling of layers. Maintain weather barrier plumb and level.
  - 2. Overlap Air Infiltration Barrier at corners of building by a minimum of 12 inches.
  - 3. Overlap Air Infiltration Barrier vertical seams by a minimum of 6 inches.
  - 4. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3 to 6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer
  - 5. Ensure barrier is plum and level with foundation, and unroll extending Air Infiltration Barrier over window and door openings.
  - 6. Attach Air Infiltration Barrier to wood, or exterior gypsum sheathings, through exterior sheathing with manufacturer recommended fasteners every 12" to 18" on vertical stud line and 24 inches on center maximum horizontally.
- C. Refer to Section 07 62 00 "Sheet Metal Flashing and Trim" for flashings at Wall Openings such as windows and doors.
- D. Tape all overlapping horizontal and vertical seams of Air Infiltration Barrier.
- E. Tape a patch over all tears and cuts in Air Infiltration Barrier.

### **3.06 FIELD QUALITY CONTROL**

- A. Notify Fluid Applied Air Barrier manufacturer's designated representative to obtain [required] periodic observations of Fluid Applied Air Barrier system installation.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections as required in Contract Documents.
- C. Inspections: Fluid Applied Air Barrier materials, accessories, and installation are subject to inspection for compliance with performance requirements.
- D. Fluid Applied Air Barrier assemblies will be considered defective upon failure of inspections and specific project testing required.
  - 1. Apply additional fluid-applied air barrier material, in accordance with manufacturer's instructions, where inspection results indicate insufficient thickness, voids, skips, pinholes or other defects as recommended by weather barrier manufacturer.
  - 2. Remove and replace deficient weather barrier system components for retesting as specified above.
- E. Repair damage to weather barriers caused by destructive testing; follow manufacturer's written instructions.



### **3.07 PROTECTION**

- A. General: Protect installed membranes and barriers from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure. Remove and replace membranes or barriers where exposed for greater than 60 days.

**END OF SECTION**

**SECTION 07 54 00**  
**THERMOPLASTIC MEMBRANE ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic roofing membrane.
- B. Flashings.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2019.
- B. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2015.
- C. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011 (Reapproved 2019).
- D. NRCA (RM) - The NRCA Roofing Manual; 2019.
- E. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
- D. Manufacturer's Qualification Statement.
- E. Warranty Documentation:
  - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 2. Submit installer's certification that installation complies with warranty conditions for waterproof membrane.

**1.05 QUALITY ASSURANCE**

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

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

**1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
  - 1. Warranty Term: 20 years.
  - 2. For repair and replacement include costs of both material and labor in warranty.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
  - 1. Carlisle Roofing Systems, Inc; Sure-Flex PVC KEE: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 2. Flex Membrane International Corporation; Flex FB PVC: [www.flexroofingsystems.com/#sle](http://www.flexroofingsystems.com/#sle).
  - 3. GAF; EverGuard PVC 50 mil: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation:
  - 1. Carlisle SynTec; SecurShield Insulation: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 2. GAF; EnergyGuard: [www.gaf.com/#sle](http://www.gaf.com/#sle).

### **2.02 ROOFING - UNBALLASTED APPLICATIONS**

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.
- B. Roofing Assembly Requirements:
  - 1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.
    - a. Calculate SRI in accordance with ASTM E1980.
    - b. Field applied coating may not be used to achieve specified SRI.
- C. Acceptable Insulation Types - Constant Thickness Application: Any of types specified.
  - 1. Minimum 2 layers of cellulose, perlite, molded polystyrene, polyisocyanurate, glass fiber, extruded polystyrene, or composite board.
  - 2. Bottom layer of cellulose, perlite, molded polystyrene, polyisocyanurate, glass fiber, extruded polystyrene, composite, or cellular glass board covered with single layer of cellulose, perlite, molded polystyrene, polyisocyanurate, glass fiber, extruded polystyrene, or composite board.
- D. Acceptable Insulation Types - Tapered Application: Any of types specified.
  - 1. Tapered polyisocyanurate, perlite, or extruded polystyrene board.
  - 2. Tapered polyisocyanurate, perlite, extruded polystyrene, or cellular glass board covered with uniform thickness cellulose, perlite, molded polystyrene, polyisocyanurate, glass fiber, extruded polystyrene, or composite board.
  - 3. Uniform thickness cellulose, perlite, composite, polyisocyanurate, extruded polystyrene, molded polystyrene, glass fiber, or cellular glass board covered with tapered polyisocyanurate, extruded polystyrene, or perlite board.

### **2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS**

- A. Membrane Roofing Materials:
  - 1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type II, sheet contains reinforcing fibers or reinforcing fabrics.
    - a. Thickness: 50 mil, 0.050 inch (1.3 mm), minimum.
  - 2. Sheet Width: Factory fabricated into largest sheets possible.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Flexible Flashing Material: Same material as membrane.

### **2.04 INSULATION**

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
  - 1. Classifications:
    - a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
      - 1) Class 1 - Nonreinforced core foam.
      - 2) Compressive Strength: 16 psi (110 kPa), minimum.
      - 3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inch (38.1 mm) thick; 9.0 (1.59) at 75 degrees F (24 degrees C).

2. Board Size: 48 by 96 inch (1220 by 2440 mm).

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

#### **3.02 PREPARATION - WOOD DECK**

- A. Verify flatness and tightness of joints of wood decking. Fill knot holes with latex filler.

#### **3.03 PREPARATION - METAL DECK**

#### **3.04 INSTALLATION, GENERAL**

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

#### **3.05 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE**

- A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
  1. Extend vapor retarder under cant strips and blocking to deck edge.
  2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.
- B. Lay subsequent layers of insulation with joints staggered minimum 6 inch (150 mm) from joints of preceding layer.
- C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- D. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. Do not install more insulation than can be covered with membrane in same day.

#### **3.06 INSTALLATION - MEMBRANE**

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (75 mm). Seal permanently waterproof. Install uniform bead of sealant to joint edge.
- D. At intersections with vertical surfaces:
  1. Extend membrane over cant strips and up a minimum of 4 inches (100 mm) onto vertical surfaces.

- 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- E. Around roof penetrations, seal flanges and flashings with flexible flashing.
- F. Coordinate installation of roof drains and sumps and related flashings.

### **3.07 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Require site attendance of roofing and insulation material manufacturers daily during installation of the work.

### **3.08 CLEANING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

### **3.09 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION**

**SECTION 07 61 00**  
**SHEET METAL ROOFING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Extent of metal roofing is shown on the Drawings and indicated by provisions of this Section.
  - 2. The following types of work are specified in this Section:
    - a. Standing Seam Roof System
    - b. Flashings
    - c. Matching Fascia
    - d. Underlayment.
      - 1) Self-Adhering Sheet Underlayment
  - 3. Related Sections:
    - a. Section 05 31 00 (05300) - Metal Deck
    - b. Section 05 40 00 (05400) - Cold-Formed Metal Framing
    - c. Section 06 10 00 (06100) - Rough Carpentry
    - d. Section 07 20 00 (07200) - Thermal Protection
    - e. Section 07 42 13 (07410) - Metal Wall Panels
    - f. Section 07 62 00 (07620) - Sheet Metal Flashing and Trim

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  - 2. D1970 "Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection"
    - a. E1646 "Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference"
    - b. E1680 "Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems"
- B. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Publications:
  - 1. "Architectural Sheet Metal Manual", Current Edition
- C. American Institute of Steel Construction Inc. (AISC) Standards.
- D. Underwriter's Laboratories, Inc. (UL) Standards:
  - 1. 580 "Tests for Uplift Resistance of Roof Assemblies"

**1.03 SYSTEM DESCRIPTION**

- A. General: Provide complete sheet metal roofing system, including, but not limited to metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.
- B. Design Loads: The basic design loads shall include roof live and snow (where applicable), wind (both external and internal), and earthquake (where applicable), in addition to dead load. All other foreign loads, whether they be of static, dynamic, or kinetic nature, shall be considered as auxiliary loads. Refer to Drawings for design loads.
- C. Air Infiltration: Provide Roof Panel System with no air leakage of not more than 0.09 cfm/sq. ft. of fixed roof area when tested in accordance with ASTM E1680 at a static-air-pressure difference of 4.0 lbf/sq. ft.
- D. Water Penetration: Provide Roof Panel System with no water penetration as defined in the test method when tested with ASTM E1646 at a minimum differential pressure of 20 percent of

inward acting, wind-load design pressure of not less than 6.24 PSF and not more than 12.0 PSF.

- E. Metal roof system shall be grounded in accordance with local Codes, as approved by the Building Department. This Contractor shall provide a provision for connection of roof grounding system to building ground system by Electrical Contractor. Coordinate with Electrical Contractor as required for complete grounding system.

#### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit metal manufacturers and fabricator's specifications, installation instructions, and general recommendations for roofing applications. Include certification or other data substantiating that materials comply with requirements.
  - 2. Samples: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, and other attachments.
  - 3. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Include the following:
    - a. Details for forming sheet metal roofing, including seams and dimensions.
    - b. Details for joining and securing sheet metal roofing, including layout of fasteners, clips, and other attachments. Include pattern of seams.
    - c. Details of termination points and assemblies, including fixed points.
    - d. Details of expansion joints, including showing direction of expansion and contraction.
    - e. Details of edge conditions, including eaves and counterflashings.
    - f. Details of special conditions.
    - g. Details of connections to adjoining work.

#### 1.05 QUALITY ASSURANCE

- A. Installer: A firm with five years of prior successful experience with installation of metal roofing of type and scope equivalent to work of this Section. Installer shall be certified in writing by the manufacturer to be an authorized and franchised dealer of the system to be furnished. Certification shall state date on which authorization was granted.
- B. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the SMACNA "Architectural Sheet Metal Manual". Conform to dimensions and profiles shown.
- C. The intent of these Specifications is to establish a quality and performance level for structural design, material, durability, and workmanship.
- D. All bidders must conform strictly to these Specifications in their Bid.
- E. The metal roofing manufacturer shall be United States based and demonstrate it has been in the business of furnishing (and/or erecting) complete building systems of similar size and complexity for a minimum of ten (10) years.
  - 1. Building system manufacturer shall be American Institute of Steel Construction Inc. (AISC), Category MB Certified.
  - 2. All materials shall be new, unused, free from defect.
  - 3. The following criteria shall also be applicable in other phases of design:
    - a. Building Code having jurisdiction over the area in which the site is located.
    - b. Structural Steel Painting Council Standards
    - c. Federal, Military, and Commercial Standards
    - d. ASTM Standards
    - e. Written Certification of Rating by: Underwriter's Laboratories, Inc. (UL) Class 90 Rating (UL Test 580). Factory Mutual Engineering Association: Class 1 and 1-90 Windstorm Classification.

4. Certification: Submit written certification prepared and signed by a professional engineer registered to practice in the State in which the Project is located, verifying that the system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
5. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
  - a. Build mockup of typical roof area, as shown on Drawings; approximately 48 inches square by full thickness, including attachments, underlayment, and accessories.
  - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
  - c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weathertight coverings and kept dry. Storage accommodations for roof and wall covering shall provide good air circulation and protection from surface staining.

#### **1.07 WARRANTY**

- A. The following guarantees shall be provided by the metal roofing manufacturer:
  1. Durability of the roof panels against rupture, structural failure, or perforation shall be guaranteed for a period of ten (10) years.
  2. The color finish for the roof and wall panels shall be guaranteed by the building manufacturer for standard term against blistering, peeling, cracking, flaking, checking, and chipping. Excessive color change and chalking shall be guaranteed for ten (10) years.
  3. Provide manufacturer's written weathertightness warranty for a maximum of ten (10) years against leaks in roofing system. Warranty shall be signed by both the manufacturer of the metal roofing system and the metal roofing system installer.

### **PRODUCTS**

#### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Preferred Manufacturers:
  1. None
  2. Approved Manufacturers:
    - a. "Standing Seam Tee-Panel System"; Berridge Manufacturing Company (800-231-8127)
    - b. "Dutch Seam (MRD) Panel System"; ATAS International, Inc. (800-468-1441)
    - c. "Snap-On-Seam SS10-12 Panel System"; Dimensional Metals Inc. (DMI) (800-828-1510)
    - d. "Snap-Clad Panels"; Petersen Aluminum Corporation (PAC-CLAD) (800-722-7150)

#### **2.02 DESIGN LOADS**

- A. The basic design loads shall include roof live and snow (where applicable), wind (both external and internal), and earthquake (where applicable), in addition to dead load. All other foreign loads, whether they be of static, dynamic, or kinetic nature, shall be considered as auxiliary loads. Refer to Drawings for design loads.

#### **2.03 ROOF COVERING**

- A. All roof constructions shall carry the Underwriter's Laboratories, Inc. (UL) Construction (Uplift) rating of not less than Class 90.
- B. Roof System
  1. The roof system shall be composed of the following:
    - a. Panels shall be nominal [11"] [12-3/4"] seam on center with snap-on seam. Fabricate from 24 gauge hot dipped galvanized (G-90) steel in accordance with ASTM A653.



- b. Panels shall be nominal [11"][12-3/4"] seam on center with snap-on seam. Fabricate from 0.032 inch Aluminum Coil Coated Sheet, ASTM B209 Alloy, smooth surface.
  - c. Fluoropolymer finish to be Kynar 500. Coating to be two-coat, thermo-cured, full-strength 70% "Kynar 500" fluoropolymer coating. Manufacturer warrants that coating shall not blister, peel, crack, chip, or experience rust-through for ten (10) years.
  - d. Custom panel widths at both ends of panel run to provide a continuous panel formed to the shape of the substrate allowing the panel leg to extend vertically and counterflash at the rake condition.
  - e. All panels to be in one continuous length without lap joints within the individual run.
  - f. Color: As shown on Exterior Finish Index.
    - 1) Deflection of the roof panel shall not exceed L/180 of its span when supporting the applicable vertical live loads previously prescribed.
2. Roof Openings
- a. Openings 12" or smaller shall be flashed by the metal roofing manufacturer.

## 2.04 UNDERLAYMENT MATERIALS

- A. Self-Adhering Sheet Underlayment:
  - 1. Type 2 (Heat Resistant Type):
    - a. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D1970, minimum of 30 mils thick; slip-resisting, polyethylene-film-reinforced top surface laminated to a heat resistive adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
    - b. Approved Products:
      - 1) "CCW WIP 300HT"; Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc. (888-229-0199)
      - 2) "Grace Ultra"; W. R. Grace & Co. (866-333-3726)
  - 2. Slip Sheet: Building paper, minimum 3 lb/100 sq. ft., rosin sized.

## 2.05 MISCELLANEOUS MATERIALS

- A. Accessories: Except as indicated as work of another specification section, provide components required for a complete roof and wall panel system, including gable and other trim, perforated and non-perforated soffit panels, closures, clips, seam covers, battens, flashings, sealants, gaskets, fillers, and similar items. Match materials and finishes of panels.
  - 1. This Contractor shall provide and install all additional structural material required to install the roof and wall systems that has not been shown on the Drawings.
  - 2. Refer to Section 07 60 00 (07600) for additional flashing requirements.
  - 3. Unless noted otherwise, provide the following sheet metal accessories, factory-formed of the same material in the same finish as roof panels:
    - a. Ridge Covers
    - b. Vented Ridge Cap
    - c. Fascias
    - d. Soffit System
    - e. Flashings
    - f. Gutters (When adjacent to metal roofing)
  - 4. Sealing Tape: Pressure-sensitive, 100 percent solids gray polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2" wide and 1/8" thick.
  - 5. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant, as recommended by the building manufacturer.

## EXECUTION

### 3.01 PREPARATION

- A. Coordinate metal roofing and wall system with rain drainage work, flashing, trim and construction of decks, parapets, walls, and other adjoining work, to provide a permanently leakproof, secure and non-corrosive installation.

### **3.02 INSTALLATION - UNDERLAYMENT**

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
- B. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."
- C. Apply slip sheet over underlayment before installing sheet metal roofing.

### **3.03 INSTALLATION - SHEET METAL ROOFING**

- A. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacture of sheet metal being fabricated and installed.
- B. Separate dissimilar metals from each other by painting each metal surface in area of contact with a bituminous coating, or by applying adhesive polyethylene underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
- C. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings and other components of metal roofing to profiles, patterns and drainage arrangements shown, and as required for permanently leakproof construction. Provide for thermal expansion and contraction of the work. Seal joints as shown, and as required for leakproof construction. Shop fabricate materials to greatest extent possible.
- D. Sealant Type Joints: Where sealant filled joints are used, embed hooked flanges of joint members not less than 1" into sealant. Form joints to completely conceal sealant. When ambient temperature is moderate at time of installation (40 deg. to 70 deg. F), set joint members for 50% movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant type joints at temperatures below 40 deg. F. Comply with requirements of Division 07 - Sealant section for the handling and installation of sealants.
- E. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
- F. Conceal fasteners and expansion provisions where possible in exposed work, and locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- G. Erection shall be in accordance with the approved erection instructions and Drawings and the requirements herein.
- H. Sheets with improper or mislocated drill holes will be rejected.
- I. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, and other foreign materials.
- J. Field cutting or burning of misaligned connections, openings and/or wall framing shall not be permitted.
- K. Stained, discolored, or damaged sheets shall be removed from the site.
- L. Arrange and next side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage.

1. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
2. Roof System: Fasten panels in accordance with the manufacturer's instructions.
3. All exposed fasteners shall be approved in advance by the Architect.
4. Side laps and end laps of roof and wall covering and joints at accessories shall be sealed.
5. Exposed fasteners shall be driven normal to the surface and to a uniform depth to properly seat the gasketed washers.
6. Accessories shall be fastened into framing members, except as otherwise approved.
7. Provide expansion joints in the roofing and/or roof framing as required to prevent damage and distress due to temperature changes.
8. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
9. Sheet Metal Accessories: Install curbs and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weathertight mounting.

#### **3.04 CLEANING AND PROTECTION**

- A. Remove protective film (if any) from exposed surfaces of metal roofing, promptly upon installation. Strip with care to avoid damage to finishes.
- B. Cleaning and Touch-up: Clean component surfaces of matter that could preclude paint bond. Touch up abrasions, marks, skips, or other defects to shop-primed surfaces with same type material as shop primer.
- C. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- D. Provide final protection in a manner acceptable to installer, which ensures metal roofing being without damage or deterioration at time of substantial completion.

#### **END OF SECTION**

**SECTION 07 72 33**  
**ROOF HATCHES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Prefabricated roof hatches with integral support curbs, operable hardware, and counterflashings.
  - 2. Prefabricated Rail System
  - 3. Ladder Safety Post
- B. Related Sections:
  - 1. Section 07 53 23 (07530) - Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
  - 2. Section 07 62 00 (07620) - Sheet Metal Flashing and Trim

**1.02 SUBMITTALS**

- A. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) with the following supporting data:
  - 1. Submit product data which shall include general construction, configurations, jointing methods, and locations when applicable, and fastening methods. Include manufacturer's instructions.

**1.03 QUALITY ASSURANCE**

- A. Standards: Comply with the following:
  - 1. SMACNA's Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
  - 2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

**1.04 PROJECT CONDITIONS**

- A. Verify that other trades with related work are complete before installing roof hatch and rail system. Coordinate installation with roof membrane and roof insulation manufacturer's instructions.
- B. Refer to the Construction Documents, shop drawings, and manufacturer's installation instructions.
- C. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- D. Observe all appropriate OSHA safety guidelines for this work
- E. Coordinate layout and installation of roof accessories with interfacing and adjoining construction to provide a leak-proof, weather-tight, secure, and non-corrosive installation.
  - 1. With [Architect's] [Owner's Representative] approval, adjust location of roof accessories that would interrupt roof drainage routes

**PRODUCTS**

**2.01 MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. The Bilco Company (203-934-6363)
  - 2. Milcor, Inc., a brand of Commercial Products Group of Hart & Cooley, Inc. (800-624-8642)
  - 3. O'Keeffe's, Inc. (888-653-3333)
  - 4. Nystrom Building Products, Inc. (800-547-2635)
  - 5. Approved Substitution.

**2.02 ROOF HATCHES**

- A. Unit: [2'-6" x 3'-0" size, single leaf type, Model "S-50"] [3'-0" x 3'-0" size, single leaf type, Model "Type E"] [2'-6" x 8'-0" size, single leaf type, Model "Type L"],, conforming to UL 790, Class A,

with "LadderUp" Model LU-1 Safety Post, as manufactured by Bilco or approved substitution by listed manufacturer.

- B. Curb: 12" height, 11 gauge aluminum, mill finish, with one inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting.
- C. Cover: 11 gauge aluminum with one inch glass fiber insulation retained by 18 gauge inner liner. Continuous gasket to provide weatherproof seal.
- D. Hardware: Manufacturer's standard manually operated type with compression spring operators, positive snap latch with turn handles inside and out and padlock hasp inside; automatic hold-open arm with vinyl covered grip handle for easy release, cadmium plated finish.
- E. Hinges: Manufacturer's recommended type.
- F. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.

### **2.03 HATCH RAIL SYSTEM**

- A. Furnish and install where indicated on plans hatch rail system Model [RL-S] [RL-E] [RL-L] as manufactured by Bilco Co. or approved Substitution. The hatch rail system shall be field assembled and installed per the manufacturer's instructions.
- B. Performance characteristics:
  - 1. High visibility safety yellow color shall be molded in.
  - 2. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
  - 3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two.
  - 4. UV and corrosion resistant construction with a twenty-five year warranty.
  - 5. Self-closing gate shall be provided with hatch rail system.
- C. Posts and Rails: Shall be round pultruded reinforced fire retardant yellow fiberglass treated with a UV inhibitor.
- D. Hardware: Mounting brackets shall be 1/4" thick hot dip galvanized steel. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.

### **2.04 ACCESSORIES**

- A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPAC2; not less than 1-1/2" thick.
- B. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
  - 1. Where removing exterior exposed fasteners affords access to building, provide nonremoveable fastener heads.
- C. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

## **EXECUTION**

### **3.01 INSTALLATION**

- A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.
- B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated.

- C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.
- D. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.
- E. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

### **3.02 CLEANING AND PROTECTION**

- A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

**END OF SECTION**

**SECTION 07 84 00**  
**FIRESTOPPING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Penetrations through fire-resistance-rated floor and roof construction, including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
  - 2. Penetrations through fire-resistance-rated walls and partitions, including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
  - 3. Joints at walls, floors, top of wall (head of wall) at floor and roof assemblies, edge of floor slabs at exterior walls, and openings around structural members which penetrate floor and wall assemblies.
- B. Related Sections:
  - 1. Section 07 81 33 (07265) - Mineral Fiber Fireproofing
  - 2. Refer to Divisions 21/22/23 and 26/27 Sections for additional requirements.

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
  - 2. E814 "Standard Test Method for Fire Tests of Through-Penetration Fire Stops"
  - 3. E1966, "Standard Test Method for Fire Resistive Joint Systems"
  - 4. E2174, "Standard Practice for On-site Inspection of Installed Fire Stops"
  - 5. E2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"
- B. Code of Federal Regulations (CFR) Publications:
  - 1. 40 CFR 763, Subpart F, Appendix A, Section 1 "Polarized Light Microscopy"
- C. Underwriter's Laboratories, Inc. (UL) Standards
  - 1. "Fire Resistance Directory"
  - 2. 1479 "Fire Tests of Through-Penetration Firestops"
  - 3. 2079 "Tests for Fire Resistance of Building Joint Systems"
- D. Warnock Hersey, ETL SEMKO division of Intertek (WHI) Publications:
  - 1. "Certification Listings"
- E. Omega Point Laboratories, Inc. ETL SEMKO division of Intertek (OPL) Publications:
  - 1. "Directory of Listed Building Products, Materials and Assemblies"

**1.03 SYSTEM DESCRIPTION**

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
- B. System Performance Requirements:
  - 1. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
  - 2. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:
    - a. Where firestop systems protect penetrations located outside of wall cavities.
    - b. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.

- c. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
  - d. Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- 3. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
- 4. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
  - a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  - b. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
- C. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

#### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
  - 1. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
    - a. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
  - 2. Provide product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
  - 3. Provide product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
  - 4. Provide manufacturer's engineering judgment identification number and drawing details when there is no UL, Warnock Hersey or OPL system available for an application. Engineering judgment must include both Project name and the contractor's name who will install firestop system as described in judgment drawing.

#### 1.05 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
  - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, OPL, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
  - 2. Through-penetration firestop systems are identical to those tested per ASTM E814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
    - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory", by Warnock Hersey, OPL or by another qualified testing and inspecting agency.
- B. Information within construction documents referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance



based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

- C. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- D. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy".
- E. Coordinate Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration and joint firestop systems are installed per specified requirements.
- F. A manufacturer's direct representative shall be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures per manufacturer's written recommendations.
- G. Engineering Judgements:
  - 1. 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 shall 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.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

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

#### **1.07 PROJECT/SITE CONDITIONS**

- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

### **PRODUCTS**

#### **2.01 APPROVED MANUFACTURERS:**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. 3M Brand Fire Protection Products (800-328-1687)
  - 2. Hilti, Inc. (800-879-6000)
  - 3. Specified Technologies Inc. (STI) (800-992-1180)
  - 4. ProSet Systems, Inc. (800-262-5355)

#### **2.02 FIRESTOPPING - GENERAL**

- A. Use only firestop products that have been UL 1479 or ASTM E814 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. Compatibility: 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 firestopping manufacturer based on testing and field experience.

1. For penetrations involving CPVC piping, provide through-penetration firestop systems which include materials that have been tested to be compatible with CPVC piping.
- C. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with the "System Performance Requirements" paragraph under "System Description" in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include, but are not limited to, the following items:
  1. Permanent Forming/Damming/Backing Materials, Including the following:
    - a. Semi-refractory Fiber (mineral wool) Insulation
    - b. Ceramic Fiber
    - c. Sealants Used in Combination with Other Forming/Damming Materials to Prevent Leakage of Fill Materials in Liquid State
    - d. Fire-rated Formboard
  2. Temporary Forming materials
  3. Substrate Primers
  4. Collars
  5. Steel Sleeves
- D. Under normal environmental conditions, all material used shall be non-corrosive to metal and compatible with synthetic cable jackets.
- E. Provide all miscellaneous items required to attach materials as specified and shown on Drawings.

## **2.03 INSTALLATION DETAILS**

- A. Refer to Details on Drawings.
- B. Systems shall include all necessary items for use in areas as shown on the Drawings.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates and conditions, with installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
  1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
  2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond. Do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

### **3.03 INSTALLATION - THROUGH-PENETRATION FIRESTOPS**

- A. General: Comply with the "System Performance Requirements" paragraph under "System Description" in Part 1, and the firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
  - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### **3.04 FIELD QUALITY CONTROL**

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

### **3.05 CLEANING**

- A. Clean-off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.
- C. Promptly remove any excess materials from any exposed finish surfaces. Repair floors, walls, or other surfaces which have been stained, marred, or otherwise damaged during installation of fire barrier materials.

**END OF SECTION**

**SECTION 07 92 00**  
**JOINT SEALANTS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Clean and Prepare Joint Surfaces
  - 2. Sealant and Backing Materials including primers, backer rods, bond breakers and accessories.
- B. Related Sections:
  - 1. Section 04 20 00 (04200) - Unit Masonry
  - 2. Section 07 24 19 (07241) - Water Drainage Exterior Insulation and Finish Systems (EIFS)
  - 3. Section 07 62 00 (07600) - Sheet Metal Flashing and Trim
  - 4. Section 07 84 00 (07840) - Firestopping
  - 5. Section 08 11 13 (08110) - Steel Doors and Frames
  - 6. Section 08 32 13 (08163) - Sliding Aluminum-Framed Glass Doors
  - 7. Section 08 14 00 (08200) - Wood and Plastic Doors
  - 8. Section 08 41 13 (08410) - Aluminum Framed Entrances and Storefronts
  - 9. Section 08 51 13 (08520) - Aluminum Windows
  - 10. Section 08 80 00 (08800) - Glazing
  - 11. Section 09 21 16 (09255) - Gypsum Board Assemblies
  - 12. Section 09 30 00 (09310) - Tiling
  - 13. Section 09 72 00 (09950) - Wall Coverings
  - 14. Section 09 90 00 (09900) - Painting

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. C834 "Standard Specification for Latex Sealants"
  - 2. C920 "Standard Specification for Elastomeric Joint Sealants"
  - 3. C1193 "Standard Guide for Use of Joint Sealants"
  - 4. C1248 "Standard Test Method for Staining of Porous Substrate by Joint Sealants"
  - 5. ASTM D1056 "Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber"
- B. Code of Federal Regulations (CFR) Publications:
  - 1. 21 CFR, Part 177 "Indirect Food Additives: Polymers"
- C. Federal Specifications (FS) Publications:
  - 1. TT-S-1543B Sealing Compound; Silicone Rubber Base (For Caulking, Sealing)
- D. Underwriter's Laboratories, Inc. (UL) Standards
  - 1. "Fire Resistance Directory"
- E. Warnock Hersey, ETL SEMKO division of Intertek (WHI) Publications:
  - 1. "Certification Listings"

**1.03 SYSTEM DESCRIPTION**

- A. Work shall include providing sealant at intersection of construction components within and exterior to building, including, but not limited to the following:
  - 1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
    - 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. Joints in exterior insulation and finish systems (EIFS).
    - e. Joints between metal panels.
    - f. Joints between different materials listed above.
    - g. Perimeter joints between materials listed above and frames of doors and windows.

- h. Control and expansion joints in ceiling and overhead surfaces.
- i. Under thresholds.
- j. Refrigerant lines and other Div. 22/23 (15) and 26 (16) items entering building.
- k. Joints in coping caps and exposed roof counter flashing.
- l. Other joints as indicated.
- 2. Exterior joints in the following horizontal traffic surfaces:
  - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
  - b. Tile control and expansion joints.
  - c. Joints between different materials listed above.
  - d. Other joints as indicated.
- 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
  - a. Control and expansion joints on exposed interior surfaces of exterior walls.
  - b. Perimeter joints of exterior openings where indicated.
  - c. Tile control and expansion joints.
  - d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
  - e. Joints on underside of precast beams and planks.
  - f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
  - g. Joints between plumbing fixtures and adjoining walls, floors, and counters.
  - h. Edge of all vinyl wallcovering installations at junctions with other materials, including ceiling joint.
  - i. Bottom edge of mirror channels
  - j. Top of tub surround
  - k. Other joints as indicated
- 4. Interior joints in the following horizontal traffic surfaces:
  - a. Control and expansion joints in cast-in-place concrete slabs.
  - b. Control and expansion joints in tile flooring.
  - c. Joints at countertops, vanities.
  - d. Under thresholds except marble.
  - e. Door bucks not flush with thresholds.
  - f. Tubs, lavatories, water closets, and other plumbing fixtures.
  - g. Perimeters of fixed kitchen equipment.
  - h. Joints of mirrors in wet areas.
  - i. Other joints as indicated.

#### **1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
  - 1. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
    - a. Include manufacturer's surface preparation and installation instructions.
    - b. List of primers recommended for each application.
  - 2. Submit samples of each color required for each type of joint sealer exposed to view in duplicate.
  - 3. Certifications: Indicate compliance with standards specified in duplicate.
- B. Where required by local building codes, provide certification from sealant manufacturer that sealants used in conjunction with EIFS installations is in compliance with EIFS manufacturers requirements.
  - 1. Affidavit Form at end of this Section shall be completed by sealant applicator and submitted with EIFS warranty.

### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. All materials shall be verified by this Contractor to be compatible with adjacent materials.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

### 1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F. and greater than 100 degrees F.
  - 2. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than, or greater than, those allowed by joint sealant manufacturer for applications indicated.

### 1.08 WARRANTY

- A. Special Warranty:
  - 1. Submit two copies of a written guarantee agreeing to repair or replace joint sealers which fail to perform as air tight and water-tight joints; or fail in joint adhesion, cohesion, abrasion resistance weather resistance, or general durability; or appear to deteriorate or become unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship or in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. Provide one-year Warranty.
    - a. Defects shall include, but are not limited to:
      - 1) Staining from abutting materials or filler.
      - 2) Migrating, bleeding into, or staining abutting materials.
      - 3) Unsightly surface deformation by causes other than movement.
      - 4) Excessive color change, chalking, or dust pick-up.
      - 5) Railing adhesively or cohesively where maximum elongation is less than 25% of designed width of exposed joints.
      - 6) Hardening to more than 25% over specified hardness.
    - b. Replace sealants which fail because of loss of cohesion or adhesion or do not cure.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Products listed below shall be as offered by one of the following manufacturers:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. Dow Corning Corp. (800-248-2481)
    - b. General Electric (GE) Silicones (800-255-8886)
    - c. BASF Building Systems (952-496-6000)
    - d. Bostik Inc. (800-523-2678)

- e. Pecora Corp. (800-523-6688)
- f. Tremco, Inc., an RPM Company (800-562-2728)

## 2.02 JOINT SEALANTS

- A. General:

## 2.03 EDIT PARAGRAPH BELOW TO SUIT PROJECT REQUIREMENTS.

- A. Colors: As shown on Interior Finish Index and Exterior Finish Index, or if not shown, match sealant material to colors of adjacent materials, as approved by [Architect] [Owner's Representative], unless indicated otherwise.
- B. Elastomeric Sealant Standard: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C920 classifications for type, grade, class, and uses.
- C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Sanitary Sealant, Interior Use:
  - 1. One component silicone rubber sealant, complying with ASTM C920, Type S, Grade NS, for Use NT, Class 25. Provide acid cure, nonporous bond type, mildew resistant silicone rubber where both joint faces are metal, glass, plastic, tile, or other non-porous material.
  - 2. Acceptable Products:
    - a. "786 Mildew Resistant"; Dow Corning Corp. (800-248-2481)
    - b. "Sanitary SCS1700"; General Electric (GE) Silicones (800-255-8886)
    - c. "Tremsil 200 Sanitary"; Tremco, Inc., an RPM Company (800-562-2728)
    - d. "898"; Pecora Corp. (800-523-6688)
- F. Interior Joints not subject to Movement:
  - 1. One part, gun grade, acrylic latex meeting the requirements of ASTM C834, Type OP, Grade NF, with 10 year life expectancy.
  - 2. Acceptable Products:
    - a. "Chem-Calk 600"; Bostik Inc. (800-523-2678)
    - b. "AC-20+"; Pecora Corp. (800-523-6688)
    - c. "Tremflex 834"; Tremco, Inc., an RPM Company (800-562-2728)
- G. Exterior joints greater than 1/2" (except E.I.F.S. areas):
  - 1. Two-part non-sag, polyurethane type, meeting ASTM C920, Type M, Grade NS, Class 50, Use NT, with 20 year life expectancy.
  - 2. Acceptable Products:
    - a. "Chem-Calk 2000"; Bostik Inc. (800-523-2678)
    - b. "Dymeric 240 or 240FC"; Tremco, Inc., an RPM Company (800-562-2728)
    - c. "Dynatrol II"; Pecora Corp. (800-523-6688)
    - d. "MasterSeal NP2"; BASF Building Systems (952-496-6000)
- H. Exterior joints less than 1/2" (except E.I.F.S. areas):
  - 1. One-part, non-sag acrylic Terpolymer formulation meeting the requirements of ASTM C920, Type S, Grade NS, Class 25, Use FT, with 20-year life expectancy.
  - 2. Acceptable Products:
    - a. "Dynatrol I-XL"; Pecora Corp. (800-523-6688)
    - b. "Dymonic"; Tremco, Inc., an RPM Company (800-562-2728)
    - c. "Vulkem 116"; Tremco, Inc., an RPM Company (800-562-2728)
    - d. "MasterSeal NP1"; BASF Building Systems (952-496-6000)
- I. Exterior Joints at E.I.F.S. Areas:

1. The following sealant materials are known to be compatible with the exterior insulation finish system (E.I.F.S.) specified in Section 07 24 00 (07240). Product utilized shall be verified by this Contractor for approval with E.I.F.S. manufacturer utilized on this Project.
  - a. Tremco, Inc., an RPM Company (800-562-2728)
    - 1) Primer: "No. P1"
    - 2) Sealant: "Dymeric 240 or Dymeric 240FC"
  - b. BASF Building Systems (952-496-6000)
    - 1) Primer: "No. 733"
    - 2) Sealant: "MasterSeal NP 2"
  - c. Pecora Corp. (800-523-6688)
    - 1) Primer: "P-75"
    - 2) Sealant: "Dynatrol II"
- J. Sealant Materials - Glazing (Installed in Field):
  1. Sealant composition shall be a silicone base, single component, solvent curing, capable of withstanding movement of up to 50 percent of joint width and shore a hardness of 26. Sealant shall conform to ASTM C920, TTS-S-001543A and TT-S-00230C (COM-NBS).
  2. Acceptable Products:
    - a. "SILGLAZE N"; General Electric (GE) Silicones (800-255-8886)
    - b. "SPECTRUM 2"; Tremco, Inc., an RPM Company (800-562-2728)

## 2.04 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Filler Backer Rod: ASTM C1330; round, closed cell polyethylene, non-gassing rod, with surface skin, sized to produce 25% compression when installed in joint.
  1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Soft Backer Rod"; BASF Building Systems (952-496-6000)
    - b. "Sof Rod"; Nomaco Inc. (800-345-7279)
    - c. "Ethafoam Rod"; Dow Chemical (800-447-4361)
- D. Bond Breaker Tape:
  1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. Pressure Sensitive 470 or 481 Polyethylene"; 3M Adhesives, Coatings and Sealers Div., (800-328-1687)
    - b. Approved Substitution
- E. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
  1. Provide cleaner conditioner required for glass and glazed surfaces as recommended by sealant manufacturer.
- F. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

## EXECUTION

### 3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory



conditions have been corrected. Beginning of Installation means acceptance of all existing conditions making this Contractor responsible for correcting all unsatisfactory and defective work encountered at his expense.

### **3.02 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
  - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellents; water; surface dirt; and frost.
  - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Remove laitance and form release agents from concrete.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears such as masonry or EIFS materials. Remove tape immediately after tooling without disturbing joint seal.

### **3.03 INSTALLATION - JOINT SEALERS**

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Surfaces and air temperature shall be greater than 30 degrees F and less than 100 degrees F.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on reconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
  - 1. Ensure that primer fully covers surfaces to which sealant is to adhere.
  - 2. Apply with bristle brush. Do not flood surfaces.
  - 3. Allow primer to dry 30 minutes minimum or as recommended by manufacturer prior to application of backing rod and sealant.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure. Bond breaker must be used in all conditions where three-sided adhesion may be possible.
- E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

4. Joint Size:
  - a. Depth of joint shall not exceed width of joint.
  - b. Minimum depth: 1/4"
  - c. Maximum depth: 1/2"
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  1. Remove excess sealants from surfaces adjacent to joint.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
    - a. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
    - b. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
    - c. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
      - 1) Use masking tape to protect adjacent surfaces of recessed tooled joints.
      - 2) All joints shall be free of air pockets, foreign embedded matter, ridges, and sags.

#### 3.04 CURE:

- A. Cure sealant in compliance with manufacturer's instructions and recommendations to obtain high, early bond strength, internal cohesion strength and surface durability.

#### 3.05 CLEANING:

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur. Remove masking material immediately following sealant application.

#### 3.06 PROTECTION:

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

#### 3.07 EXTERIOR SEALANT AFFIDAVIT

#### 3.08 (ATTACH TO EIFS PROJECT WARRANTY)

SEALANT SUB-CONTRACTOR  
COMPANY:

\_\_\_\_\_  
(TYPE NAME)

COMPLETION DATE:

\_\_\_\_\_

THE SEALANT INSTALLED IN CONJUNCTION WITH

\_\_\_\_\_  
(NAME OF EIFS  
MFG)

EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) INSTALLED ON THE STRUCTURE BELOW  
LOCATED AT THE ADDRESS INDICATED BELOW:

TO: \_\_\_\_\_ **CONFORMS** \_\_\_\_\_ **DOES NOT CONFORM**

\_\_\_\_\_  
(NAME OF EIFS  
MFG)

AND

\_\_\_\_\_  
(SEALANT MFG'S.  
NAME)

RECOMMENDED INSTALLATION PRACTICES AND PROJECT MANUAL SECTION 07 92 00 (JOINT  
SEALANT SPECIFICATION)

**NAME & ADDRESS OF STRUCTURE**

**PRODUCT COMPONENT NAMES**

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PRIMER(S):  
 SEALERS:  
 BOND BREAKERS:  
 SEALANT  
 MATERIAL:

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INSTALLATION	CONFORMS	DOES NOT CONFORM
A. DESIGNER'S REQUIREMENTS, DETAILS		
B. SEALANT MANUFACTURER'S DETAILS AND REQUIREMENTS		
C. EXTERIOR INSULATION DETAILS AND REQUIREMENTS		
D. THE INFORMATION ENTERED ABOVE IS OFFERED IN <b>TESTIMONY</b> THAT THE <b>SEALANT</b> INSTALLATION CONFORMS WITH THE LISTED SEALANT MANUFACTURER'S INSTALLATION METHODS AND PROCEDURES AND THE EIFS MANUFACTURER'S MINIMUM RECOMMENDATIONS..		

SEALANT INSTALLER COMPANY NAME & ADDRESS:
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SIGNATURE OF RESPONSIBLE OFFICER:  
 TYPED NAME AND TITLE OF OFFICER:  
 TELEPHONE NUMBER:

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(  
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DATE SIGNED:

**END OF SECTION**

**SECTION 08 11 13**  
**HOLLOW METAL DOORS AND FRAMES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Interior Hollow Metal Doors and Frames
  - 2. Exterior Hollow Metal Doors and Frames
  - 3. Prehung Mirrored Closet Door
    - a. Aluminum Framed Mirror Guestroom Closet Door Complete with Door Hardware
- B. Related Sections:
  - 1. Section 07 92 00 (07920) - Joint Sealants
  - 2. Section 08 14 00 (08200) - Wood Doors
  - 3. Section 08 71 00 (08710) - Door Hardware
  - 4. Section 08 80 00 (08800) - Glazing
  - 5. Section 09 90 00 (09900) - Painting

**1.02 REFERENCES**

- A. ASTM International (ASTM) Publications:
  - 1. A153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
  - 2. A568 "Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for"
  - 3. A591 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  - 4. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  - 5. A924 "Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process"
  - 6. A1008 "Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
  - 7. A1011 "Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
  - 8. C143 "Standard Test Method for Slump of Hydraulic Cement Concrete"
  - 9. C476 "Standard Specification for Grout for Masonry"
  - 10. E90 "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"
  - 11. E413 "Classification for Rating Sound Insulation"
  - 12. E2074 "Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies"
- B. American National Standards Institute (ANSI) Publications:
  - 1. ANSI/SDI A250.3 "Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames"
  - 2. ANSI/SDI A250.4 "Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings"
  - 3. ANSI/SDI A250.6 "Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames"
  - 4. ANSI/SDI A250.8 - SDI-100 "Recommended Specifications for Standard Steel Doors and Frames"
  - 5. ANSI/SDI A250.10 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames"
  - 6. ANSI/SDI A250.11 "Recommended Erection Instructions for Steel Frames (Formerly SDI-105)"
- C. ANSI/DHI Publications:
  - 1. DHI A115.1G "Installation Guide for Doors and Hardware"

- D. Commercial Standards
  - 1. CS-242-62
- E. National Association of Architectural Metal Manufacturers (NAAMM) Publications:
  - 1. "Metal Finishes Manual for Architectural and Metal Products"
- F. National Fire Protection Association (NFPA) Publications:
  - 1. NFPA 80 "Standard for Fire Doors and Windows"
  - 2. NFPA 105 "Hot Smoke Test"
  - 3. NFPA 252 "Standard Methods of Fire Tests of Door Assemblies"
- G. National Association of Architectural Metal Manufacturers (NAAMM) Publications:
  - 1. "Metal Finishes Manual for Architectural and Metal Products"
- H. Steel Door Institute (SDI) Publications:
  - 1. SDI 105 through 128
- I. Underwriter's Laboratories, Inc. (UL) Standards
  - 1. UL Building Materials Directory; Underwriters Laboratories Inc.
  - 2. UL 10B "Standard for Fire Tests of Door Assemblies"
  - 3. UL 10C "Positive Pressure Fire Tests of Door Assemblies"
  - 4. UL 1784 "Air Leakage Tests of Door Assemblies"
  - 5. Procedure No. R-3791
  - 6. Procedure No. R-3821
- J. Warnock Hersey, ETL SEMKO division of Intertek (WHI) Publications:
  - 1. "Certification Listings"

### 1.03 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance and temperature-rise ratings, and finishes for each type of steel door and frame specified.
  - 2. Submit Shop Drawings and product data indicating pertinent dimensioning, construction, component connections and locations, anchorage methods and locations, hardware locations and installation details, and the following:
    - a. Elevations of each door design.
    - b. Details of doors including vertical and horizontal edge details.
    - c. Frame details for each frame type including dimensioned profiles.
    - d. Details and locations of reinforcement and preparations for hardware.
    - e. Details of each different wall opening condition.
    - f. Details of anchorages, accessories, joints, and connections.
    - g. Coordination of glazing frames and stops with glass and glazing requirements.
  - 3. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
    - a. Indicate coordination of glazing frames and stops with glass and glazing requirements.

## 1.05 QUALITY ASSURANCE

- A. Hollow metal doors and frames shall be fabricated in accordance with standards and specifications established by Steel Door Institute, complying with ANSI A250.8-1998 (SDI-100) "Recommended Specifications for Standard Steel Doors and Frames" and as specified.
- B. Acoustical qualities: Doors shall have a minimum sound transmission classification (STC) of 29 per ASTM E413, when tested in a fixed position according to ASTM E90.
- C. Fire-Rated Door Assemblies: Units that comply with NFPA 80 are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E2074, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated. Test pressure shall be tested in accordance with NFPA 252, or UL 10C to comply with local code requirements.
- D. Opening assemblies shall meet the requirements of NFPA 105 Hot Smoke Test.
- E. All stairwell doors and other doors as may be shown on the Drawings shall comply with the temperature-rise rating of 450 degrees F. maximum in 30 minutes of fire exposure.
- F. Installer Qualifications: Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.
  - 1. Assembly and installation shall be performed by qualified personnel who have successfully completed manufacturer's prefinished steel door frame installation course and have been approved by the manufacturer.
  - 2. Certificate: When requested, submit certificate indicating qualification.
- G. Inspection: General Contractor shall provide in writing to Owner an inspection of all steel doors and frames for conformance to specifications. Inspection shall include checking for fit tolerance plumb and level as well as proper hardware and operation.
  - 1. Comply with the requirements of the International Building Code with testing in accordance with UL 10C for positive pressure door test.
    - a. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
    - b. Doors shall be labeled to certify compliance.
    - c. Provide installation instructions attached to each door in a manner that assures availability to the installer and building official.
- H. Fire-Rated, Borrowed Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257, or UL 9.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work cardboard wrapped or crated to provide protection during transit and job storage.
  - 1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
  - 2. Deliver welded frames with two removable spreader bars across bottom of frames.
- B. Label each item, before shipping, with metal or plastic tags to show their location, size, door swing, and other pertinent information.
- C. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to [Architect] [Owner's Representative]. Remove and replace damaged items that cannot be repaired as directed.
- D. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

## 1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) recommended by manufacturer for optimum results. Do not install products environmental conditions outside manufacturer's absolute limits.

## 1.08 COORDINATION

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

## PRODUCTS

### 2.01 DISTRIBUTOR

- A. Preferred Manufacturers:
  - 1. Contract Hardware, Inc. (404-350-9408)
    - a. Contact: Mark Tew

### 2.02 MANUFACTURERS

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Steelcraft, an Allegion Brand (888-758-9823)
  - 2. Ceco Door, an ASSA ABLOY Group Company (615-661-5030)
  - 3. Republic Doors and Frames (800-733-3667)
  - 4. CURRIES, an ASSA ABLOY Group Company (800-377-3948)

### 2.03 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A1011 and A568, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets ASTM A1008 and A568, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Electrolytic Zinc-Coated Steel Sheet: ASTM A591, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.
- D. Hot dipped zinc coated steel shall be of the alloyed type and comply with ASTM A924 and A653.
- E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A153, Class B.
- F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A153.
- G. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC Paint 20.
- J. Hardware reinforcing on doors and frames shall comply with ANSI/SDI A250.6. The physical performance levels shall be in accordance with ANSI/SDI A250.4.

## 2.04 HOLLOW METAL FRAMES

- A. General:
  - 1. Fabricate steel frame units to comply with ANSI/SDI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Conceal fastenings, unless otherwise indicated.
- B. Location and Type: All metal frames for doors shall be formed of steel to sizes and shapes indicated. Frames shall be fabricated with continuously welded corners unit type construction at joints [, unless noted otherwise for Prefinished Frames]. Frames shall be furnished with Underwriter's Laboratories label, as required, at the place of manufacturer.
- C. Type and Gauges of Metal: Metal for frames shall be cold-rolled or hot-rolled, pickled and oiled, steel sheets with clean, smooth surfaces. Except where other gauges are indicated or specified, frames shall be fabricated from steel, not lighter than the standard Manufacturers Standard Gauge (MSG) as referenced in ANSI A250.8 :
  - 1. Interior Frames of 16-gauge (0.053-inch) thick steel sheet for:
    - a. Door openings wider than 48 inches.
    - b. Level 2 steel doors.
    - c. Wood doors, unless otherwise indicated.
  - 2. Exterior Frames of 16-gauge (0.053-inch) thick steel sheet for:
    - a. Door openings wider than 48 inches.
    - b. Level 2 steel doors.
    - c. Level 3 steel doors.
  - 3. Exterior frames shall be 0.30 per square foot per side, hot-dipped galvanized or electrolytic zinc-coated steel with a stretcher level degree of flatness.
- D. Workmanship and Design: The finished work shall be strong and rigid, neat in appearance, and free from defects. Fabricate members straight and true with corner joints well-formed, in true alignment and fastenings concealed where practicable.
- E. Drywall Frames (Interior Guestroom Door Frames):
  - 1. Drywall frames shall be the same as flush frames except:
  - 2. Frames shall be formed with double return backbends to prevent cutting into drywall surface. Frames shall be knocked down, designed to be securely installed in the rough opening after wallboard is applied. Mitered corners shall be reinforced with a wedge lock corner clip to provide a firm interlock of jambs to head.
  - 3. Each jamb shall have an adjustable anchor located 4" from the top of the door opening to hold frame in rigid alignment. Frames shall have a welded-in base anchor attaching plate in each jamb for field installation of loose base anchors or frames shall have two (2) dimpled holes in each jamb for anchoring base of frame with screws.
- F. Forming Corner Joints: Joints for welded-type frames shall be mitered and continuously arc-welded for full depth and width of frame and trim. All contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush.
- G. Provision for Hardware: Frames shall be prepared at the factory for the installation of hardware. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware, unless more stringent requirements are indicated. Welding of hinges to frames will not be permitted. Frames shall be mortised, reinforced, drilled, and tapped to templates to receive all mortised hardware. Provide cover boxes in back of all hardware cut-outs. Lock strikes shall be set out and adjusted to provide clearance for silencers.
  - 1. Provide preparation for rubber silencers on interior room door frames; three per strike jamb at single doors.
  - 2. Provide concealed metal reinforcements for hardware as required. The gauges of metal for reinforcement shall be in accordance with the manufacturer's recommendations for the type of hardware and the thickness and width of doors to be hung in the frame, provided



that the gauges used are not lighter than those required by Commercial Standard CS-242-62.

- a. Galvanized for exterior doors.
3. All frames shall have a security anchor system installed on strike jamb consisting of a compression anchor at 3-1/2" from head of door frame and a "Z" type security anchor at 45" above floor.
- H. Wall Anchors: Provide metal anchors of shapes and sizes required for the adjoining type of wall construction. Locate anchors on jambs near the top and bottom of each frame and at intermediate points not over 24 inches apart. Galvanized anchors for exterior frames.
  1. Anchor types shall be varied to provide positive fastening to adjacent construction.
  2. Provide UL approved anchors for UL labeled frames. Anchorage of UL label frames shall conform to printed UL test report for door frame manufactured.
- I. Plaster Guards: Provide 0.016-inch-thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation. Required at all door strikes.
- J. Floor Anchors: Provide floor clips of not less than 16-gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be adjustable and drilled for 3/8" diameter anchor bolts.
- K. Shipment: For welded type frames, provide temporary steel spreaders fastened across bottom of frames. Where construction will permit concealment, leave spreaders in place after installation. Otherwise, remove spreaders after frames are set and anchored. In place of spreaders, frames may be strapped together in pairs with heads inverted for bracing during shipment. Before shipping, label each frame with metal or plastic tapes to show their location, size, door swing, and other pertinent information.

## **2.05 PREFINISHED FRAMES (PF)**

- A. Manufacturers:
  1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "C-Series Frames"; Timely Industries, Inc. (800-247-6242)
    - b. Rediframe Products Division, Dunbarton Corporation, Inc. (800-633-7553)
- B. Materials:
  1. Frame: Provide minimum 18 gauge, cold-rolled steel sheet conforming to ASTM A366.
  2. Casing: Provide minimum 22 gauge prefinished steel snap-on type with corner alignment clips.
    - a. Profile: Square
  3. Fasteners: Types and sizes specified in manufacturer's installation instructions for project conditions.
  4. Workmanship and Design: The finished work shall be strong and rigid, neat in appearance, and free from defects. Fabricate members straight and true with corner joints well-formed, in true alignment and fastenings concealed where practicable.
  5. Provision for Hardware: Frames shall be prepared at the factory for the installation of hardware. Welding of hinges to frames will not be permitted. Frames shall be mortised, reinforced, drilled, and tapped to templates to receive all mortised hardware. Provide cover boxes in back of all hardware cut-outs. Lock strikes shall be set out and adjusted to provide clearance for silencers.
    - a. Provide preparation for rubber silencers on interior room door frames; three per strike jamb at single doors.
    - b. Provide concealed metal reinforcements for hardware as required. The gauges of metal for reinforcement shall be in accordance with the manufacturer's recommendations for the type of hardware and the thickness and width of doors to be hung in the frame, provided that the gauges used are not lighter than those required by Commercial Standard CS-242-62.

- c. All frames shall have a security anchor system installed on strike jamb
    - 1) Provide safeguard at strike to prevent entry by prying.
- 6. Wall Anchors: Provide metal anchors of shapes and sizes required for the adjoining type of wall construction. Locate anchors on jambs near the top and bottom of each frame and at intermediate points not over 24 inches apart. Anchor the frame to the wall with fasteners every 11-inches around the perimeter of the frame.
  - a. Anchor types shall be varied to provide positive fastening to adjacent construction.
- 7. Provide UL approved anchors for UL labeled frames. Anchorage of UL label frames shall conform to printed UL test report for door frame manufactured.
- 8. Finishes:
  - a. Factory-Applied Paint Finish: Manufacturer's standard, factory-applied baked enamel paint finish complying with ANSI A250.3 for performance and acceptance criteria.
    - 1) Color: [Custom] [Standard] color to match color as shown on Interior Finish Index.

## 2.06 FRAME INSULATION

- A. Glass fiber, semi-rigid board, 2" thickness, unfaced, 3 lb. density.
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Type 703" - Owens-Corning Fiberglass Corp (800-438-7465)
    - b. Substitutions: None accepted

## 2.07 HOLLOW METAL DOORS

- A. General:
  - 1. Fabricate steel door units to comply with ANSI/SDI A250.8. and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Hollow Metal Doors:
  - 1. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical-endurance level.
  - 2. Interior Flush Door:
    - a. Model: "L Series"; Steelcraft, an Allegion Brand, or approved substitution by other listed manufacturers.
    - b. Level 2, Heavy Duty, 18-gage, and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
    - c. Thickness: 1-3/4"
    - d. Cores: Per ANSI/SDI A250.8
      - 1) Doors shall be reinforced, stiffened, sound deadened and insulated with impregnated Kraft honeycomb core completely filling the inside of the doors and laminated to inside faces of both panels using contact adhesive applied to both panels and honeycomb core.
    - e. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.
  - 3. Interior Temperature Rise Doors
    - a. Temperature rise doors shall be the same as flush door construction except core material shall be designed to produce the 450 degree temperature rise rating.
    - b. Cores: Per ANSI/SDI A250.8:
    - c. Mineral-Fiber Board: For labeled doors if a temperature-rise limit is required.
  - 4. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical-endurance level:
    - a. Flush Door:
      - 1) Thickness: 1-3/4"
      - 2) Model: "L Series"; Steelcraft, an Allegion Brand, or approved substitution by other listed manufacturers.

- 3) Level 3, Extra Heavy Duty, 16-gage, and Physical Performance Level B (Extra Heavy Duty), Model 2 (Seamless).
  - b. Exterior doors shall be fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C236 or ASTM C976 on fully operable door assemblies. Provide thermal-rated assemblies with U-factor of 0.24 or better. Hot-dipped galvanized or electrolytic zinc-coated steel with a stretcher level degree of flatness.
  - c. All exterior swing-out doors shall have the top and bottoms closed to eliminate moisture penetration. Door tops shall not have holes or openings.
- C. Door Louvers:
1. Furnish and install louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch thick, cold-rolled steel sheet set into 0.032-inch thick steel frame.
    - a. Provide stationary sight-proof louvers with inverted V-Shaped or Y-Shaped blades of sizes and locations as shown on the Drawings.
    - b. Provide Fire-Rated Automatic Louvers of sizes and locations as shown on the Drawings at fire-rated openings.
      - 1) Louvers to be constructed with movable blades closed by actuating fusible links and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same testing and inspecting agency that established fire-resistance rating of door assembly.
- D. Door Fabrication:
1. Fabricate doors and frames in accordance with ANSI/SDI A250.8.
  2. Workmanship: The finished work shall be rigid, neat in appearance, and free from defects; form molding members straight and true with joints coped or mitered, well formed and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so they are invisible after finishing.
  3. Door Sizes and Clearances: Doors shall be of type, sizes, and design indicated. The clearances for doors shall be 1/8" at jambs and heads and 3/4" at bottom, unless indicated or specified otherwise. Clearances at meeting edges of pairs of doors shall be 1/4" (1/8" on fire doors).
    - a. Clearances for Fire-Rated Doors: As required by ANSI/NFPA 80.
  4. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  5. Provisions for Hardware: Mortise, reinforce, drill, and tap doors at factory to receive all mortise-type hardware. Provide reinforcing only for doors to receive surface-applied hardware, except push plates and kick plates; drilling and tapping for surface-applied hardware will be done in the field. Provide metal reinforcing plates for surface-applied hardware as required. The gauges of metal for reinforcing plates shall comply with manufacturer's recommendation for the type of hardware used and the size and thickness of doors, provided that the minimum requirements are as follows:
    - a. Hinge Reinforcement - 3/16 Inch
    - b. Strike Reinforcement - 11 Gauge
    - c. Closers and Bracket Reinforcement - 12 Gauge
    - d. Mortise Covers - 26 Gauge
    - e. The gauges used shall not be lighter than those required by Commercial Standard CS 242-62.
  6. Glazing Preparation:
    - a. Doors indicated to have glass shall have non-removable glazing stops on the exterior sides of the openings and removable or snap-on type stops on the inside of the openings.
    - b. Provide manufacturer's vision lites of sizes and locations as shown on Drawings, recessed into the door face similar to "Dezigner Trim" by Steelcraft, or approved substitution by listed manufacturers.
    - c. Stops shall be UL approved for UL labeled doors.

- E. Doors with labels shall carry Underwriters label on the door and on the frame. They shall be constructed to meet Procedure No. R-3791 and R-3821, as listed by Underwriters Laboratories.

## **2.08 PREHUNG MIRRORED CLOSET DOOR**

- A. Aluminum Framed Mirror Guestroom Closet Door Complete with Door Hardware
1. Preferred Manufacturers:
    - a. Mirrored Doors:
      - 1) None
  2. Approved Manufacturers:
    - a. Mirrored Doors:
      - 1) "Model ALCO-1904"; Alco Doors (800-747-9663)
      - 2) "Slimfold Model 4175 Double-Sided Mirror Door with Pre-Hung Aluminum Frame"; Dunbarton Corporation, Inc. (800-633-7553)
  3. Comply with the following requirements:
    - a. Door is constructed of double sided mirror with 1" Anodized Aluminum Frame.
    - b. Mirror:
      - 1) Mirror Facing: Smooth-edged, silvered, mirrored, vinyl-backed safety glass complying with CPSC 16 CFR 1201 for Category II safety glass with ANSI Z97.1 test procedures; with ASTM C1036 for Type I (transparent, flat), Class 1(clear), Quality q2 (mirror) annealed float glass; with FS DD-M-411 for coating system applied to second glass surface; and with the following:
        - 2) Glass Thickness: 1/8" thickness each
        - 3) Provide two (2) layers of mirrors back-to-back.
    - c. Hardware (ALCO Door):
      - 1) Hinges: 3 each ALCO-124FH Flag Hinge x US26
      - 2) Ball Catch: 1 each ALCO-3W, Brushed Stainless Chrome finish
      - 3) Pull: 1 each ALCO-4000128 Custom Hand Pull, 5-5/8" H x 1-9/16" D x 5/8" square, 5" center to center for screw holes. Brushed Stainless Steel finish.
    - d. Hardware (Slimfold Door):
      - 1) Hinges: 3 each Flag Hinge x US26
      - 2) Ball Catch: 1 each Adjustable, Brushed Stainless Chrome finish
      - 3) Pull: 1 each Hand Pull, 5-9/16" H x 1-3/8" D, 4" center to center for screw holes. Brushed Stainless Steel finish.

## **2.09 FINISHES**

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish steel doors and frames after assembly.
- B. Factory Prime Coating for Field Painted Finish: Unless specified otherwise, provide manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI/SDI A250.10 for acceptance criteria.
1. Clean and chemically treat metal surfaces to assure maximum paint adherence. Follow with a dip or spray coat of lead-free, rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer on all exposed surfaces. Finished surfaces shall be smooth and free from irregularities and rough spots.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.

### 3.02 GENERAL

- A. Fabricate and install hollow metal units and their accessories in strict accordance with these Specifications and manufacturer's data.
- B. Hardware: For installation see Division 08, "Door Hardware" Section of these Specifications.

### 3.03 PLACING FRAMES

- A. Comply with the provisions of the "Steel Door Institute" 105, unless otherwise indicated.
- B. Set frames accurately in position, plumbed, aligned, and braced until permanent anchors are set.
  - 1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
- C. Field apply bituminous coating to backs of frames that will be filled with grout. Install door silencers in frames before grouting.
- D. Where grouting is required in masonry installations, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand trowelled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
- E. Frame Insulation: Install insulation in frames of gypsum board partitions. Cut insulation to full width of frame throat and friction fit within the jamb and head. Pack solid around perimeter of the frame.
- F. Anchor bottom of frames to floors with expansion bolts, or with power fasteners. Build wall anchors into walls or secure to adjoining construction as indicated or specified. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to ceiling or structural framing above as indicated and specified.
  - 1. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
  - 2. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
  - 3. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.
- G. Install fire-rated frames in accordance with NFPA Standard No. 80.
- H. Casings:
  - 1. Install casings in accordance with manufacturer's printed instructions.
  - 2. Installation of wood casings is specified in Section 06 20 00 (06200)

### 3.04 DOOR INSTALLATION

- A. Door Installation: Comply with ANSI A250.8. Fit hollow metal doors accurately in their respective frames within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G .
- B. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
- C. Smoke-Control Doors: Install to comply with NFPA 105.

### 3.05 ADJUSTMENT

- A. Check and re-adjust operating finish hardware items in hollow metal work just prior to final inspection.
- B. Remove and replace defective work including doors or frames which are warped, bowed, or otherwise damaged.
- C. Finished Doors: Refinish or replace doors damaged during installation.
- D. Protect doors as recommended by door manufacturer to ensure that doors will be without damage or deterioration at time of Substantial Completion.

### **3.06 TOUCH-UP**

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- B. Repairs: Fill surface depressions with metallic paste filler, allow to cure, and sand flush for invisible joint with adjacent metal surfaces. Sand rust areas and apply touch-up paint using air drying paints compatible with shop finish. Damaged doors or frames that cannot be repaired shall be replaced.

### **3.07 CLEANING:**

- A. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.
- B. Upon completion, metal surfaces of doors and frames that are completely factory finished shall be thoroughly cleaned and touched-up as recommended by the door manufacturer.

**END OF SECTION**

**SECTION 08 14 00**  
**WOOD DOORS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Types of doors required include the following:
    - a. Wood Doors with Plastic Laminate Faces
      - 1) Solid Core Flush Doors at Guestroom Entry Doors, Guestroom Bath Doors and Guestroom Connector Doors, Public Space Doors (Where Shown), Back-of-House Doors (Where Shown),
- B. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry
  - 2. Section 06 20 00 - Finish Carpentry
  - 3. Section 08 11 13 - Hollow Metal Doors and Frames
  - 4. Section 08 41 13 - Aluminum Framed Entrances and Storefronts
  - 5. Section 08 71 00 - Door Hardware
  - 6. Section 08 80 00 - Glazing
  - 7. Section 09 90 00 - Painting

**1.02 REFERENCES**

- A. Window and Door Manufacturers Association (WDMA) Publications:
  - 1. I.S.1-A "Architectural Wood Flush Doors"
  - 2. I.S.6, "Industry Standard for Wood Stile and Rail Doors"
- B. Architectural Woodwork Institute (AWI) Publications:
  - 1. "Architectural Woodwork Quality Standards"
- C. American National Standards Institute (ANSI) Publications:
  - 1. ANSI/AHA A135.4 "Basic Hardboard"
  - 2. ANSI 208.1 "Standards for the Performance of Particleboard"
  - 3. ANSI Z97.1 "Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings"
- D. ASTM International (ASTM) Publications:
  - 1. C920 "Standard Specification for Elastomeric Joint Sealants"
  - 2. C1036 "Standard Specification for Flat Glass"
  - 3. E90 "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"
  - 4. E413 "Classification for Rating Sound Insulation"
- E. Door and Hardware Institute (DHI) Publications:
  - 1. DHI-WDHS-3 "Recommended Hardware Locations for Wood Flush Doors"
  - 2. DHI A115 "Steel Door Preparation Standards"
- F. National Fire Protection Association (NFPA) Publications:
  - 1. NFPA 80 "Standard for Fire Doors, Fire Windows"
- G. Underwriter's Laboratories, Inc. (UL) Standards
  - 1. UL 10B "Standard for Fire Tests of Door Assemblies"
  - 2. UL 10C "Positive Pressure Fire Tests of Door Assemblies"

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.

1. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
2. Shop Drawings: Submit Shop Drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.
  - a. Submittals shall use the same designations for door and hardware numbers as shown on the Drawings.

#### 1.04 QUALITY ASSURANCE

- A. Quality Standards: Comply with the following standards:
  1. WDMA Quality Standard: I.S.1-A "Architectural Wood Flush Doors", and I.S.6, "Industry Standard for Wood Stile and Rail Doors" of Window and Door Manufacturers Association (WDMA).
  2. AWI Quality Standard: "Architectural Woodwork Quality Standards", including Section 1300 "Architectural Flush Doors", and Section 100-S-3 "Moisture Content", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of WDMA quality standard.
- B. Sound Transmission Class:
  1. All guestroom entrance doors from interior corridors, together with their perimeter seals shall have a minimum Sound Transmission Class (STC) of [31] per ASTM E413. when tested in an operable condition according to ASTM E90.
  2. All guestroom communicating doors, at each of the two doors in the opening, together with their perimeter seals shall have a minimum Sound Transmission Class (STC) of [35] per ASTM E413. when tested in an operable condition according to ASTM E90.
  3. All other entrance doors from interior corridors, together with their perimeter seals shall have a minimum Sound Transmission Class (STC) of [26] per ASTM E413. when tested in a fixed position according to ASTM E90.
- C. Safety Glass: Provide products complying with ANSI Z97.1 and testing requirements of 16 CFR, Part 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.
- D. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80, are identical in materials and construction to units tested in door and frame assemblies per ASTM E152, and which are labeled and listed for ratings indicated by Underwriters Laboratory (UL), Warnock Hersey, ETL SEMKO division of Intertek (WHI), or other testing and inspection agency acceptable to authorities having jurisdiction.
  1. Provide rated stiles on fire rated doors.
  2. Comply with the requirements of the International Building Code with testing in accordance with UL 10C for positive pressure door test.
    - a. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
    - b. Doors shall be labeled to certify compliance.
    - c. Provide installation instructions attached to each door in a manner that assures availability to the installer and building official.
- E. Manufacturer: Obtain doors from one source.
- F. Inspection: General Contractor shall provide in writing to [Architect] [Owner's Representative], an inspection of all doors and frames for conformance to specifications. Inspection shall include checking for fit tolerance, plumb and level, as well as proper hardware and operation.

#### 1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of WDMA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.



1. Individually Package doors in vented poly bags with identifying marks prior to shipment. Doors shall not be removed from bags until ready to hang. After hanging, bags shall be placed over doors to provide protection until area in which doors are hung is free of construction traffic.
  2. Store doors off the floor at least 3" in an area that is not susceptible to standing water or high moisture. Store doors in an upright position with spacers or corner caps separating each door.
- B. Identify each door with individual opening numbers which correlate with designation system used on Shop Drawings for door, frames, and hardware, using temporary, removable or concealed markings.

#### **1.06 PROJECT CONDITIONS**

- A. Conditioning: Do not deliver or install doors until building is enclosed, wet work is complete, and conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to Project's geographical location:
1. Referenced AWI quality standard including Section 100-S-11, "Relative Humidity and Moisture Content".

#### **1.07 SPECIAL WARRANTY**

- A. General: Warranties shall be in addition to and run concurrent with, and not be a limitation of, other rights the Owner may have under the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer and General Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) more than 1/4 inch in a 42" x 84" section, or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span, or do not conform to tolerance limitations of referenced quality standards.
1. Warranty shall also include reinstallation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
  2. Warranty shall be in effect during the following period after date of Substantial Completion:
    - a. Solid-Core Interior Doors: Life of installation.
    - b. Solid Core Exterior Doors: [One Year] [Two years] from date of Substantial Completion.
    - c. Stile & Rail Interior Doors:
      - 1) Non-Rated: Life of installation.
      - 2) 20 minute Fire Rated: Life of installation.
      - 3) 45, 60, or 90 minute Fire Rated: One year from date of Substantial Completion.
- C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's Warranty.

### **PRODUCTS**

#### **2.01 DISTRIBUTORS**

- A. Avendra, LLC Preferred Distributor:
1. Contract Hardware, Inc. (800-266-3418)
    - a. Contact: Mark Tew

#### **2.02 PLASTIC FACED WOOD DOORS**

- A. Preferred Manufacturers:
1. Flush Doors
    - a. None
- B. Approved Manufacturers:
1. Flush Doors
    - a. VT Industries Inc. (800-827-1615)
    - b. Mohawk Flush Doors, a Masonite Company (570-473-3557)
    - c. Eggers Industries (920-793-1351)

- d. Marshfield DoorSystems, a Masonite Company (800-869-3667)
- e. Eggers Industries
- C. Solid Core Doors for Laminate Finish: Comply with the following requirements:
  - 1. Faces:
    - a. Plastic Laminate: NEMA LD-3, General Purpose 0.050 inch HPDL, Grade 50, color and pattern as shown on Interior Finish Index.
    - b. AWI Grade: Custom
    - c. Construction: 3-Ply
    - d. Core:
      - 1) Solid Core Doors: Particleboard, ANSI/208.1, 1-LD-2
    - e. Thickness: 1-3/4"
    - f. Factory seal top and bottom rails.
    - g. Facing Adhesive: Type I - Water-proof.
    - h. Blocking: Provide either hardwood or structural composite lumber wood blocking in particleboard-core doors as follows:
      - 1) Top Rail (No Closer): Minimum 1-1/8 inch.
      - 2) Top Rail (Closer): Minimum 5-inch remaining after installation. Verify with closer manufacturer.
      - 3) Bottom Rail: Minimum 1-1/8 inch after undercut.
      - 4) Bottom Rail: 5-inch bottom-rail in doors indicated to have kick, mop, or armor plates.
      - 5) Midrail: 5-inch midrail blocking, in doors indicated to have exit devices at location of exit device.
    - i. Stiles: Hardwood or structural composite lumber, minimum 1-3/8" wide before sanding. Plastic-laminate matching faces, applied before faces.
- D. Fire-Rated Solid Core Laminate Doors: Comply with the following requirements.
  - 1. Faces: Provide faces to match non-rated doors in same area of building, unless otherwise indicated.
    - a. Construction: Manufacturer's core construction as required to provide fire-resistance rating indicated.
    - b. Blocking: Provide either hardwood or structural composite lumber wood blocking in particleboard-core doors or as required to meet specified fire rating and as follows:
      - 1) Top Rail (No Closer): Minimum 1-1/8 inch.
      - 2) Top Rail (Closer): Minimum 5-inch remaining after installation. Verify with closer manufacturer.
      - 3) Bottom Rail: Minimum 1-1/8 inch after undercut.
      - 4) Bottom Rail: 5-inch bottom-rail in doors indicated to have kick, mop, or armor plates.
      - 5) Midrail: 5-inch midrail blocking, in doors indicated to have exit devices at location of exit device.
    - c. Stiles: Provide stiles consisting of two plies.
      - 1) The inner-ply shall be minimum 1-3/8 inches Structural Composite Lumber (SCL) or approved non-combustible material on 20 minute rated doors, On 45, 60, and 90 minute rated doors, the inner-ply shall be 1-inch of Structural Composite lumber or approved combustible material.
      - 2) The outer-ply shall be of plastic laminate to match faces of door. Laminate edge to be applied before the face laminate.
      - 3) Provide edge construction with intumescent seals concealed by outer stile matching plastic laminate in accordance with "Category A" Guidelines as published by ITS/Warnock Hersey, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
        - (a) Intumescent seals shall not be exposed on the vertical edges of the door.
        - (b) Surface applied intumescent seals will not be permitted on the door or frame.

- 4) Pairs: Provide fire-rated pairs with fire-retardant stiles matching plastic laminate that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. [Provide stiles with concealed intumescent seals].

## 2.03 LOUVERS AND LIGHT FRAMES

- A. Wood Louvers (except at full louver doors): Door manufacturer's standard solid-wood louvers, unless otherwise indicated. Size as indicated on Mechanical Drawings.
- B. Fire Door Louvers: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of one and one-half hours and less. Size as indicated on Mechanical Drawings.
  1. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.
- C. Wood Beads for Light Openings in Wood Doors:
  1. Wood Species: Same species as door faces, painted to match laminate at laminate doors.
  2. Profile: Flush rectangular beads.
  3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.
- D. Wood-Veneered Beads for Light Openings in Fire Doors: At fire-rated door locations except, 20-minute rated doors, provide manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.
- E. Refer to Section 08 80 00 (08800) for glazing.

## 2.04 FABRICATION - GENERAL

- A. Fabricate wood doors to produce doors complying with following requirements:
  1. Fabricate fire rated doors in accordance with AWI Quality Standards and to UL or Warnock Hersey, ETL SEMKO division of Intertek (WHI) requirements. Attach fire rating label to door and frame. Stiles, rails and core shall be fully bonded together with adhesive and sanded smooth prior to laminating of face veneer.
  2. Stiles, rails and core shall be fully bonded together with adhesive and sanded smooth prior to laminating of face veneer.
  3. Cross bands and faces for PC and FD type doors shall be laminated to core by the hot or cold plate process.
  4. Solid Core Doors for Laminate Finish:
    - a. Vertical Exposed Edge of Stiles: Plastic laminate same as door facing.
    - b. Laminate edge to be applied before the face laminate.
    - c. Factory-prefit and pre-machine doors to fit frame opening sizes indicated with the following uniform clearances and bevels:
      - 1) Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory pre-machining.
      - 2) Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
      - 3) Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
      - 4) Factory drill pilot holes for hinge and lock face plate screws.
      - 5) Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory pre-machining.
    - d. Undercut:
      - 1) Guestroom Entry Door = 1/4" above threshold.
      - 2) Guestroom Connector = 1/2" above threshold as coordinated with door bottom. (15/16" above concrete)
      - 3) Guest Bathroom Door = 3/8" above threshold.

- 4) Doors swinging over carpet = 3/4" above top of concrete subfloor.
- B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.
  1. Light Openings: Trim openings with moldings of material and profile indicated.
  2. Louvers: Factory install louvers in prepared openings.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
  1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails.
- D. Pre-Assembled Doors and Frames:
  1. Coordinate with Section 08 71 00 (08710) for all hardware requirements, including installation.

## **2.05 FABRICATION - STILE AND RAIL WOOD DOORS**

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
  1. Clearances: Provide 1/8 inch at heads. Provide 3/32 inch at jambs, and between pairs of doors. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8 inch from bottom of door to top of threshold.
    - a. Comply with NFPA 80 for fire-rated doors.
    - b. Bevel fire-rated doors 1/8 inch in 2 inches on lock edge; trim stiles and rails only to extent permitted by labeling agency.
      - 1) Undercut: [1-inch] above top of concrete subfloor.
- B. Door shall be assembled with mortise and tenon or doweled joints.
- C. Pre-machining: Pre-machine and pre-fit door for hardware specified in Section 08 71 00 (08700) - Hardware.
- D. Glazed Openings: Glaze doors at factory with glass of type and thickness indicated, complying with Division 08 Section "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C920. Secure glass in place with removable wood stops.
- E. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish, and quality of construction.

## **2.06 SHOP PRIMING**

- A. Doors for Opaque (Painted) Finish:
  1. Shop prime faces and edges of doors, including cutouts, with two coat of wood primer specified in Section 09 90 00 (09900) "Painting".
    - a. Match primer-sealer color to color of finish coats; refer to Finish Index on Drawings for paint color.
- B. Doors for Transparent (Stained) Finish:
  1. Shop seal faces and edge of doors, including cutouts, with stain (if required), other required pretreatments, and first coat of finish as specified in Section 09 90 00 (09900) "Painting".

## **2.07 FACTORY FINISHING**

- A. Transparent (Stain) Finish:
  1. Factory-applied by Manufacturer following AWI Section 1500 requirements for Custom Grade "TR-6". Finish shall consist of a four-coat process with a minimum 3-mil dry film thickness on all surfaces.
    - a. Apply vinyl wash coat by spray or roller; fully pad into surfaces and wipe off.
    - b. Apply stain by spray or roller; fully pad surfaces and wipe off.
    - c. Sand lightly using 220-grit paper.
    - d. Apply final finish of two coats of clear, transparent, catalyzed vinyl resin by spray or roller.

## EXECUTION

### 3.01 EXAMINATION

- A. Examine installed door frames prior to hanging door.
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
  - 2. Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Hardware: For installation see Section 08 71 00 "Door Hardware".
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.
  - 1. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA 80.
- C. Job-Fit Doors:
  - 1. Field-verify dimensions of each new installed door frame; trim each door as required to properly fit each frame within specified dimensional tolerances; unequal trimming may be required.
  - 2. Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and matching.
    - a. Trim non-rated doors equally from both sides when fitting for width and from top and bottom when fitting for height. Do not trim more than 3/4" from each edge.
    - b. Fitting Clearances for Non-Rated Doors: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
    - c. Fitting Clearances for Fire-Rated Doors: Complying with NFPA 80.
    - d. Bevel non-rated doors 1/8" in 2" at lock and hinge edges.
    - e. Bevel fire-rated doors 1/8" in 2" at lock edge, trim stiles and rails only to extent permitted by labeling agency.
- D. Hang doors and adjust for proper clearances and smooth operation without binding.
  - 1. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
  - 2. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- E. Field-Finished Doors: Refer to the following for finishing requirements:
  - 1. Section 09 90 00 (09900), "Painting"
  - 2. Seal field cuts in top and bottom rails and for hardware with 2 coats of a VOC compliant paint or varnish.

### 3.03 ADJUSTING, CLEANING, AND PROTECTION

- A. Operation: Rehang or replace doors which do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation.
- C. Clean door and dry wipe with a soft cloth.
- D. After installation, protect doors from damage as recommended by manufacturer during subsequent construction activities. Damaged doors will be rejected and shall be replaced at no additional cost to Owner.

## END OF SECTION

**SECTION 08 31 00**  
**ACCESS DOORS AND PANELS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Access Doors and Frames of the Following Types:
    - a. Wall Access Doors
    - b. Moisture Resistant Access Doors
    - c. Ceiling Access Doors
    - d. Floor/Ceiling System Access Doors
    - e. Sprinkler System Access Doors
- B. Related Sections:
  - 1. Section 04 20 00 (4200) - Unit Masonry
  - 2. Section 09 21 16 (09255) - Gypsum Board Assemblies
  - 3. Section 09 21 16.23 (09265) - Gypsum Board Shaft-Wall Assemblies
  - 4. Section 09 51 23 (09512) - Acoustical Tile Ceilings
  - 5. Section 09 90 00 (09900) - Painting
  - 6. Division 21, 22 and 23 Sections for coordination of access to valves and other concealed items.

**1.02 REFERENCES**

- A. ASTM International (ASTM) Publications:
  - 1. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
- B. National Association of Architectural Metal Manufacturers (NAAMM) Publications:
  - 1. "Metal Finishes Manual"
- C. National Fire Protection Association (NFPA) Publications:
  - 1. NFPA 80 "Standard for Fire Doors, Fire Windows"
  - 2. NFPA 252 "Standard Methods of Fire Tests of Door Assemblies"
- D. Underwriter's Laboratories, Inc. (UL) Standards
  - 1. UL 10B "Standard for Fire Tests of Door Assemblies"
  - 2. UL 263 "Standard for Fire Tests of Building Construction and Materials"

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Shop Drawings and Samples:
    - a. Submit copies of Shop Drawings of all items specified herein to [Architect] [Owner's Representative] for approval. Obtain approval of Drawings prior to proceeding with manufacturing. Shop Drawings shall indicate: Elevations of each door type; Details of each frame type; Location in the building for each item; Conditions at openings with various wall thicknesses and material; Typical and special details of construction; Methods of assembling sections; Locations and installation requirements for hardware; Size, shape, and thickness of materials; Joints and connections.

**1.04 QUALITY ASSURANCE**

- A. Access doors shall be fabricated in accordance with standards and specifications established by Steel Door Institute.
- B. Fire Rated Access Doors and Frames: Comply with NFPA 80. Provide products listed by UL or another testing agency acceptable to local jurisdictions on each fire rated access door. Where required by local codes comply with the following:

### 1.05 EDIT LIST BELOW TO SUIT PROJECT.

- A. ASTM E119
- B. NFPA 252
- C. UL 10B
- D. UL 263
- E. Access panels shall be flush with finished wall or ceilings, except where panels are located in acoustic tile or paneling, the door shall be recessed to receive adjacent finish material.
- F. Access panel finishes shall be coordinated with the finish treatment of the area.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver access doors cartoned or crated to provide protection during transit and job storage.

## PRODUCTS

### 2.01 SHOP PAINTING

- A. Apply a primed finish to all ferrous metal surfaces furnished under this Section. Clean and chemically treat metal surfaces to assure maximum paint adherence. Follow with a dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer on all exposed surfaces. Finished surfaces shall be smooth and free from irregularities and rough spots. Each coat of paint shall be separately baked or oven dried. The time and temperature for drying shall be in accordance with manufacturer's recommendations for developing maximum hardness and resistance to abrasion.

### 2.02 ACCESS UNITS

### 2.03 DELETE TYPES NOT USED ON PROJECT. ALL SIZES TO BE SHOWN ON DRAWINGS.

- A. Wall Access Doors (Non-rated):
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "WB Series"; J.L. Industries (800-554-6077)
    - b. "Type RDW"; Karp Associates, Inc. (800-888-4212)
    - c. "Model NW Series"; Nystrom Building Products (800-547-2635)
    - d. "Style DW"; Milcor, Inc., a brand of Commercial Products Group of Hart & Cooley, Inc. (800-624-8642)
  - 3. Door Size: Select from manufacturer's standard sizes to suit required opening.
  - 4. Designed for flush installation in wall construction. Construct of metal with concealed continuous hinge, having recessed screwdriver latch, size as indicated.
- B. Wall Access Doors (Fire-Rated):
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "FDWB Series"; J.L. Industries (800-554-6077)
    - b. "Type KRP-450 FR"; Karp Associates, Inc. (800-888-4212)
    - c. "IW Model Series"; Nystrom Building Products (800-547-2635)
  - 3. Door Size: Select from manufacturer's standard sizes to suit required opening.
  - 4. Fire Rating: [1] [1-1/2] hour labeled.
- C. Moisture Resistant Access Doors (Non-rated):
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. Larsen "L-MPSS" stainless steel frame and "L-MPSS" stainless steel door, by Larsen's Manufacturing Co., with continuous, offset and concealed hinge, security fastener. (800-527-7367)

- D. Ceiling Access Doors (Non-rated):
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Model RDW"; Karp Associates, Inc. (800-888-4212)
    - b. "Style DW"; Milcor, Inc., a brand of Commercial Products Group of Hart & Cooley, Inc. (800-624-8642)
    - c. Model WB-DW; Williams Brothers Corporation of America (800-255-5515)
    - d. "WB Series"; J.L. Industries (800-554-6077)
    - e. "NW Series"; Nystrom Building Products (800-447-2635)
  3. Performance Criteria
    - a. Door Size: Select from manufacturer's standard sizes to suit required opening.
    - b. Sheet metal construction with concealed continuous hinge, flush design. Provide each door with self-closing mechanism and standard flush design "self-latching" latch.
- E. Ceiling Access Doors (Fire-Rated):
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Model KRP-350FR"; Karp Associates, Inc. (800-888-4212)
    - b. "Model WB-FRC"; Williams Brothers Corporation of America (800-255-3515)
    - c. "FDWB Series"; J.L. Industries (800-554-6077)
    - d. "IW Series"; Nystrom Building Products (800-447-2635)
  3. Performance Criteria:
    - a. Door Size: Select from manufacturer's standard sizes to suit required opening.
    - b. Fire Rating: [1] [1-1/2] hour labeled.
    - c. Sheet metal construction with concealed continuous hinge, flush design. Provide each door with self-closing mechanism and standard flush design "self-latching" latch.
- F. Floor/Ceiling System Access Doors (Fire Rated)
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Model 3210"; Milcor, Inc., a brand of Commercial Products Group of Hart & Cooley, Inc. (800-624-8642)
    - b. Approved substitution by Williams Brothers Corporation of America
    - c. Approved substitution by J.L. Industries (800-554-6077)
    - d. Approved substitution by Nystrom Building Products (800-447-2635)
    - e. Approved Substitution by Karp Associates, Inc. (800-888-4212)
  3. Performance Criteria:
    - a. Size: Select from manufacturer's standard sizes to suit required opening.
    - b. Fire Rating: [1] [1-1/2] hour labeled.
    - c. Sheet metal construction with concealed continuous hinge, flush design. Provide each door with self-closing mechanism and standard flush design "self-latching" latch.
    - d. Finish: Bonderized galvanized steel.
- G. Sprinkler System Access Doors (Fire-rated)
1. Performance Criteria:
    - a. UL B (1-1/2 hr.) rated with automatic closer, UL rated anchors for construction in which door will be installed, and lockset with knob released keyed as directed by Owner.
  2. Preferred Manufacturers:
    - a. None
  3. Approved Manufacturers:
    - a. Milcor, Inc., a brand of Commercial Products Group of Hart & Cooley, Inc. (800-624-8642)



- b. Karp Associates, Inc. (718-784-2105)
- c. Williams Brothers Corporation of America (309-796-2371)

## **2.04 MATERIALS**

## **2.05 FABRICATION**

- A. Grind exposed welds smooth and flush with adjacent surfaces.
- B. Provide all required attachment devices and fasteners to secure units to substrates.

## **2.06 FINISHES**

- A. Base Metal Protection: Factory prime coat units with electrostatic baked on electrostatic powder. Prime exposed edges with coat of white rust-inhibitive paint.
  - 1. For steel finishes comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products".
- B. For fire-rated access doors, furnish units with ceramic fiberboard panel insert, attach to outside face of door, ready for field painting.

## **EXECUTION**

### **3.01 GENERAL**

- A. Verify rough openings for door and frame are correctly sized and located.
- B. Beginning of installation means acceptance of existing conditions.

### **3.02 INSTALLATION**

- A. Install units and their accessories in accordance with final Shop Drawings, manufacturer's data, and as herein specified.
- B. Install frame plumb and level in wall and ceiling openings. Position to provide convenient access to concealed work requiring access. Secure rigidly in place.

### **3.03 ADJUSTMENT**

- A. Check and readjust operating finish hardware items in work just prior to final inspection.
- B. Remove and replace defective work including doors or frames which are warped, bowed, or otherwise damaged.

### **3.04 TOUCH-UP**

- A. Immediately after erection of work, sand smooth any rusted or damaged areas of prime coat and touch-up of compatible air drying primer.

### **3.05 PROTECTION:**

- A. Protect doors and frames from damage during transportation and at the job site; store at the site under cover on wood blocking or on suitable floors. After installation, protect doors and frames from damage during subsequent construction activities. Damaged work will be rejected and shall be replaced with new work. Factory enameled finished work shall be shipped in cartons or other suitable containers.

### **3.06 CLEANING:**

- A. Upon completion, metal surfaces of doors and frames that are completely factory finished shall be thoroughly cleaned and touched-up as recommended by the door manufacturer.

## **END OF SECTION**

**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Interior and Exterior Aluminum Storefront Framing, Doors, Door Frames, Lights, and Fixed Windows.
  - 2. Aluminum Framed Interior Glass Partition Wall System with Sliding Glass Panels
    - a. Business Library
    - b. Anchors, Brackets, and Attachments
    - c. Door Hardware
    - d. Perimeter Sealant
- B. Work Installed but Furnished Under Other Sections:
  - 1. Section 08 71 00 - Door Hardware: Additional Door hardware items other than specified in this Section, and keying requirements.

**1.02 REFERENCES**

- A. American Architectural Manufacturers Association (AAMA) Publications:
  - 1. AAMA "Storefront and Entrance Manual"
  - 2. 10 "Care and Handling of Architectural Aluminum from Shop to Site"
  - 3. 609 / 610-02 "Cleaning and Maintenance Guide for Architecturally Finished Aluminum"
  - 4. 611 "Voluntary Specification for Anodized Architectural Aluminum"
  - 5. 5.
  - 6. 2604 "Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels"
  - 7. 2605 "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels"
- B. American National Standards Institute (ANSI) Publications:
  - 1. ANSI/AAMA 101 "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors"
- C. ASTM International (ASTM) Publications:
  - 1. A36 "Standard Specification for Carbon Structural Steel"
  - 2. A123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"
  - 3. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  - 4. B221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes"
  - 5. E236 "Standard Specification for Apparatus For Microdetermination Of Alkoxy Groups"
  - 6. E283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen"
  - 7. E330 "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
  - 8. E331 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference"
- D. National Fenestration Rating Council (NFRC)
- E. Underwriter's Laboratories, Inc. (UL) Standards
- F. Glass Association of North America (GANA) Publications
  - 1. "Glazing Manual"
  - 2. "Laminated Glazing Reference Manual"
  - 3. GANA Bulletin 01-0300, "Proper Procedures for Cleaning Architectural Glass Products"

### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit Shop Drawings and product data and manufacturer's installation instructions. Include system and component dimensions; components within assembly; framed opening requirements and tolerances; anchorage and fasteners; glass and infills; door hardware requirements; and affected related work.
    - a. Field Measurements: Verify opening and layout dimensions of glass partition system by field measurements prior to fabrication and record measurements on Shop Drawings.

### 1.04 QUALITY ASSURANCE

- A. All systems to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F. without causing detrimental effects to system or components.
- B. Qualifications:
  - 1. Manufacturer: [Glass partition and ]Storefront manufacturer to have minimum five (5) years documented experience in the fabrication of glass partitions of the type required for this project and be capable of providing field service representation during installation.
  - 2. Installer: Minimum two (2) years documented experience in work of this Section and approved by each partition system manufacturer.
  - 3. Source Limitations: Obtain Glass Partition System materials from one manufacturer for entire Project, unless otherwise acceptable to Architect.
- C. All storefront units shall be manufactured by a single source.
  - 1. All storefront systems in any one project must be by the same manufacturer and with comparable frame depth, profile, glazing bite and installation requirements. Manufacturer must provide a storefront system that can incorporate all window configurations used on the project.
    - a. Sections 08 41 13, 08 51 13, and 08 80 00 to be furnished by single source insuring product compatibility and coordination.
- D. Exterior Systems:
  - 1. Design for windload of 30 PSF with maximum deflection in both vertical and horizontal mullions not to exceed 1/175 of span.
  - 2. Comply with the applicable standards of ANSI/AAMA 101 and the following:
    - a. AAMA 10
    - b. AAMA 260
    - c. AAMA 609/610
    - d. Certify that the proposed products have been tested to the following performance standards at an Independent Testing Laboratory accredited by AAMA and using the referenced ASTM standards:
      - 1) Water Penetration: ASTM E331 no water penetration at a test pressure of 6.24 PSF.
      - 2) Structural Properties: 30 PSF acting inward and outward per ASTM E330. Deflection not to exceed 1/175 of span.
      - 3) Air Leakage per ASTM E283:
        - (a) Fixed window walls - maximum of 0.06 CFM per sq. ft. of total exterior surface areas.
      - 4) Thermal Performance: Composite glass wall shall meet or exceed the "U" value shown on the Drawings and as tested per ASTM E236.
    - e. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.
  - 3. Glass Partition Wall System Performance / Design Criteria

- a. Impact Safety Resistance: CPSC 16 CFR 1201, Cat. I & II
- b. Design Criteria:
  - 1) Structural - Live Load: Glass partition system to be designed to withstand live loads in accordance with governing state and federal codes, rules and regulations of the authority having jurisdiction (AHJ).
    - (a) Deflection: Maximum L/120
- c. Structural Stability: Meet requirements of BS 5234 (partition structural requirements), and BS 6180 (protective barriers)
  - 1) Partitions installed under IBC to be laterally supported in accordance with IBC Section 1621.1.2, ASCE 7 Section 9.6.2.8.
  - 2) Seismic Requirements under provisions of IBC Section 1705.2
- E. All systems shall accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.

## **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Transportation and Handling: Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry. Provide equipment and personnel to handle products by method to prevent soiling or damage. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- B. Storage and Protection: Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

## **PRODUCTS**

### **2.01 MANUFACTURERS**

- A. For purpose of designating design and quality of aluminum storefront system, fixed window system, Drawings and Specifications are based on the following:
  - 1. Storefront and Fixed Window Framing System: Insulated Glazing (Tempered)
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Approved Manufacturers:
        - (a) "Trifab VersaGlaze 451T", Kawneer North America, an Alcoa Company. (770-449-5555)
        - (b) "FG-3000 MultiPlane", Oldcastle BuildingEnvelope (formally Vistawall) (866-653-2278)
        - (c) "System 403 T", EFCO Corporation (800-221-4169)
        - (d) (678-838-6000)
    - b. Entry Doors:
      - 1) Style and rail tubular member door framing system by same manufacturer of storefront framing system, compatible with specified framing system.
      - 2) Style: [Wide] [Medium] [or] [narrow] style, as indicated on Drawings.
      - 3) Thermal Construction: [High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior] <Insert description>.
      - 4) Provide nonremovable glazing stops on outside of door.

### **2.02 ALUMINUM FRAMED INTERIOR GLASS PARTITION WALL SYSTEM WITH SLIDING GLASS PANELS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "RS3000 System"; Richelieu America
    - a. Contact: Michael Baer (704-330-0114)

- b. "MCY2000 System"; Hafele America, Hospitality Group
    - 1) Contact: Ty LeFever (815-315-3410)
- 2. System Description:
  - a. Full Height Aluminum Single-glazed partition system. Provide all components required for a complete system including a total of four (4) Framed Panels (framed on 4 Sides) with Two (2) Stationary and Two (2) Sliding Panels that slide behind Fixed Panels on Business Library side. No intermediate framing will be permitted. All four (4) panels shall be of equal width.
    - 1) System shall be designed to be capable of withstanding normal impact loads.
    - 2) b.
  - b. Aluminum Framing: Maximum 2" x 4". Match adjacent exterior framing as close as possible.
  - c. Guide System: Shall be one of the following:
    - 1) Bottom Rolling, Top Guide
      - (a) Top of bottom track to be flush with top of finished floor material. Refer to Drawings and Interior Finish Index for materials. Basis of Design is the "" by Richelieu America, or by other listed manufacturers.
    - 2) System:
      - (a) system with a guide at the.
  - d. Systems shall have internal leveling system, and be adjustable for field conditions.
  - e. Size: Panels to be equal widths, as shown on Drawings
  - f. Glazing: Custom Decorative Laminated Glass supplied by Section 08 80 00 - Glazing
    - 1) Overall Thickness:
    - 2) Refer to Interior Finish Index for Decorative Glazing.
    - 3) Regulatory Requirements: Provide tempered or laminated safety glass for locations subject to human impact as required by the governing codes, rules, and regulations of authorities having jurisdiction (AHJ).
    - 4) Hardware: Provide all required hardware, anchors, seals and miscellaneous trim necessary to complete all work. Lock and pulls are not required.
- 3. Materials:
  - a. Aluminum Extrusions: ASTM B221, 6063-T6 alloy and temper
  - b. Stainless Steel: ASTM A276, Type 304
  - c. Fasteners: Type best suited to application, and acceptable to glass partition system manufacturer.

## 2.03 MATERIALS

- A. All framing members shall be extruded aluminum of 6063T-5 alloy and shall be of the size, shape, and intended function as shown on the Drawings. Performance requirements shall conform to standards established by the Architect in relation to wind load and deflection limits.
- B. Fasteners: Stainless Steel

## 2.04 FINISH:

- A. Glass Partition Wall System Aluminum:
  - 1. All exposed aluminum surfaces shall have a manufactured-applied, 10-year warranted, AAMA 2604, Liquid or Powder Fluoropolymer coating not less than 50% polyvinylidene fluoride resin (PVDF) by weight finish, free from blemishes and surface defects. Powder coat is an acceptable alternative finish.
  - 2. Color to match adjacent exterior storefront framing system.

## 2.05 FABRICATION

- A. Storefront Systems:
  - 1. Aluminum door shall have tight hairline joints where rails are fitted against stiles and shall be fastened by means of tensioned steel tie rods in top and bottom rails. Doors shall have an adjusting mechanism in the top rail to provide for minor clearance adjustments. Glass stops shall be snap-in type with bulb type glazing strips. Weather stripping shall be pile.

2. Store front sections shall be square cut and assembled with the proper clips and screws as provided by the manufacturer to form neat hairline joints. All fastenings shall be concealed except those specifically detailed by the Architect at certain transition areas. All glazing gaskets shall be cut over length and installed in slight linear compression to prevent shrinkage from the corners. All framing shall be erected square and true into correct size rough openings prepared by others and in strict accord with the Architectural Drawings.
3. Doors: Reinforce doors as required for installing hardware, including electronic strikes and card readers.
  - a. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
  - b. At exterior doors, provide weather sweeps applied to door bottoms.
  - c. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
  - d. Glass Partition Wall System:
    - 1) Fabricate glazing units in sizes indicated by approved shop drawings, with edge and face clearances, edge and surface conditions, and, where indicated, bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
      - (a) Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
      - (b) Grind smooth and polish exposed glass edges and corners.
    - 2) Accurately fit and secure joints and intersections.
    - 3) Make joints flush and hairline.
    - 4) Prepare components to receive anchor devices and hardware. Fabricate anchorage items.
    - 5) Arrange fasteners, attachments, and jointing to ensure concealment from view.

## **2.06 STOREFRONT SYSTEM - HARDWARE**

### **2.07 JOINT SEALANTS**

- A. For metal to metal joints use Standard Products Company Stan Pro Urethane Epoxy Sealant No. 103, Dow Corning Silicone Rubber Sealant, or other as acceptable to [Architect][Owner's Representative], color to match finish of aluminum to which applied.
- B. For perimeter of framing members, refer to Section 07 92 00- Joint Sealants.

## **EXECUTION**

### **3.01 INSPECTION**

- A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

### **3.02 INSTALLATION**

- A. Install doors, frames, glazing and hardware in accordance with manufacturer's instructions and AAMA "Storefront and Entrance Manual" guide specifications.
- B. Install Glass in accordance with Glass Association of North America "Glazing Manual" and "Laminated Glazing Reference Manual".
- C. Use anchorage devices to securely attach frame assembly to structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Tolerances:
  1. Maximum Variation from Plumb or Level: 1/8 inch in 3 feet or 1/4 inch in any 10 feet, whichever is less.
  2. Maximum Misalignment of Members Abutting End to End: 1/16 inch.

- F. Coordinate attachment and seal of air and vapor barrier materials. Install sill flashings where required.
- G. Weathertight Construction: Install sill members and other members in a bed of sealant or with joint filler or gaskets, to provide weathertight construction.
  - 1. Refer to Section 07 92 00 "Joint Sealants" for installation requirements.
- H. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious, stone or other dissimilar materials.
- I. Install glass and infill panels in accordance with Section 08 80 00 using exterior wet method of glazing.
- J. Install perimeter non-hardening, non-skinning type sealant, and installation requirements in accordance with Section 07 92 00.
- K. Adjust operating hardware

### **3.03 TOLERANCES**

- A. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.
- B. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

### **3.04 CLEANING**

- A. Remove protective material from prefinished aluminum surfaces.
- B. Wash-down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

**END OF SECTION**

**SECTION 08 42 29**  
**AUTOMATIC ENTRANCES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
- B. [Bi-parting] [Single-slide] Sliding Unit, with Fixed Sidelites

**1.02 RELATED SECTIONS:**

- A. Section 07 92 00 - Joint Sealants
- B. Section 08 41 13 - Aluminum Entrances and Storefront
- C. Section 08 71 00 - Door Hardware
- D. Section 08 80 00 - Glazing
- E. Division 26 - Electrical: Wiring

**1.03 REFERENCES**

- A. American Architectural Manufacturers Association (AAMA) Publications:
- B. 2604 "Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels"
- C. 2605 "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels"
  - 1. American Society of Civil Engineers (ASCE) Publications:
- D. 7 "Minimum Design Loads for Buildings and Other Structures"
  - 1. ASTM International (ASTM) Publications:
- E. B209 "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate"
- F. B221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes"
- G. E283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen"
  - 1. American National Standards Institute (ANSI) /Builders Hardware Manufacturers Association (BHMA) Publications:
- H. ANSI/BHMA A156.10, "Power Operated Pedestrian Doors"
- I. ANSI/BHMA A156.19 - "Power Assist and Low Energy Power Operated Doors"
  - 1. American Welding Society (AWS) Publications:
- J. D1.2 "Structural Welding Code--Aluminum"
- K. A5.10 "Specification For Bare Aluminum And Aluminum-Alloy Welding Electrodes And Rods"
- L. BHMA A156.19 - American National Standard for Power Assist and Low Energy Power Operated Doors.
  - 1. National Fire Protection Association (NFPA) Publications:
- M. 70 "National Electric Code"
  - 1. The Society for Protective Coatings (SSPC) Publications:
- N. Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film)

**1.04 DEFINITIONS**

- A. Refer to BHMA A156.10 for definitions of terms.
- B. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Fixed Sidelight System: Exterior sliding active leaves swing out from any position in sliding mode.



- D. Full Breakout System: Interior sliding active leave and sidelites swing out from any position in sliding mode.
- E. Safety Device: Device that prevents a door from opening or closing.

#### **1.05 SYSTEM DESCRIPTION**

- A. General: Provide automatic entrance door systems that have the following capabilities based on testing manufacturer's standard units in assemblies similar to those indicated for this Project:
- B. Thermal Movements: Provide automatic entrance doors that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): [120] deg F, ambient; [180] deg F, material surfaces.
- C. Operating Temperature Range: Provide automatic entrance door operators capable of operating between minus [30] [20] [10] deg F and plus [120] deg F.
- D. Structural Performance: Provide automatic entrance doors capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Basic Wind Speed: As indicated in miles per hour (meters per second) at 33 feet (10 m) above grade. Determine wind loads and resulting design pressures applicable to Project according to the following, based on mean roof heights above grade as indicated on Drawings:
    - a. Wind Loads: ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure."
    - b. Windborne-Debris-Impact-Resistance-Test Performance: Provide automatic entrances that pass [large missile-impact] [small missile-impact] and cyclic-pressure tests of [ASTM E 1996 according to the IBC] [Insert governing code requirement].
- E. Air Infiltration:
  - 1. Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of door area when tested at an inward pressure differential of 1.57 lb/sq. ft. according to ASTM E283.
  - 2. Maximum air leakage for full breakout glazing and framing areas of 1.30 cfm/sq. ft. of door area when tested at an inward pressure differential of 1.57 lb/sq. ft. according to ASTM E283.
- F. Opening Force: Maximum opening force of [5] lbf in accordance with [Americans with Disabilities Act (ADA)] [insert governing code]. Not more than [50] lbf required to manually set door in motion of power fails, and not more than [15] lbf required to open door to minimum required width.
- G. Entrapment Force Requirements: Not more than [30] lbf required to prevent stopped door from closing.

#### **1.06 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrance doors.
- C. Product Certificates: Signed by manufacturers of automatic entrance doors certifying that products furnished comply with emergency exit door requirements.
- D. Maintenance Data: For door operators and control systems to include in maintenance manuals specified in Division 01. Include instructions on how to perform safety tests, and the name, address, and telephone number of nearest authorized service representative.
  - 1. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other Work.

- E. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
- G. Design Calculations: Calculate requirements for seismic restraints.

#### **1.07 QUALITY ASSURANCE**

- A. All Entrance units shall be manufactured by a single source.
- B. All Entrance Systems in any one project must be by the same manufacturer and with comparable frame depth, profile, glazing bite and installation requirements.
- C. Manufacturer must provide an Entrance System that can integrate with all adjacent storefront and window configurations used on the Project.
  - 1. Sections [08 32 13,] 08 41 13, [08 42 29], 08 51 13, and 08 80 00 to be furnished by single source insuring matching color(s), product compatibility and coordination.
  - 2. Installer Qualifications: An experienced installer who is an authorized representative of the automatic entrance door manufacturer for both installation and maintenance of units required for this Project.
- D. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
  - 1. All systems to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F. without causing detrimental effects to system or components.
  - 2. Welding Standards: Comply with AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. Comply with ANSI/BHMA A156.10, "Power Operated Pedestrian Doors."
  - 4. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 5. Emergency Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.

#### **1.08 PROJECT CONDITIONS**

- A. Field Measurements: Verify automatic entrance door openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

#### **1.09 COORDINATION**

- A. Coordinate size and location of recesses in concrete floors for recessed sliding tracks. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 - "Cast-in-Place Concrete."
- B. Electrical System Rough-In: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies and security access control system.

#### **1.10 WARRANTY**

- A. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty - System and Components:
- C. General: Written warranty, executed by manufacturer agreeing to repair or replace components of the automatic entrance door system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty or sporadic operation of automatic door operator, including controls.

- b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
  - c. Lateral deflection of glass lite edges in excess of 1/175 of their length or 3/4 inch, whichever is less.
  - d. Excessive air leakage.
  - e. Warranty Period: Two years from date of Substantial Completion.
  - f. All materials shall be free from manufacturing defects and defects in installation workmanship. Any material or workmanship judged defective during this period shall be removed and replaced at no cost to the Owner.
2. Special Warranty - Finishes:
- D. [Organic Liquid Coating][Powder Coating]: Furnish manufacturer's Ten (10) year warranty providing coverage for the following:
- 1. Will not chip, crack or peel (lose adhesion) but this does not include minute fracturing which may occur in proper fabrication of building parts.
  - 2. Will not chalk in excess of ASTM D4214 Number 8 rating, determined by procedure outlines in ASTM D4214.
  - 3. Will not change color more than five Delta-E Hunter units (square root of the sum of square Delta L, Delta a, and Delta b) as determined by ASTM D2244, Method 6.3. Fading or color changes may not be uniform if surfaces are not equally exposed to sun and elements. Mica and metallic coatings are exempt due to inability to accurately measure color; mica and metallic flakes reflect and scatter light in random patterns.
- E. [Organic Liquid Coating][Powder Coating]: Furnish manufacturer's [Ten (10)] [Twenty (20)] year warranty providing coverage for the following:
- 1. Will not chip, crack or peel (lose adhesion) but this does not include minute fracturing which may occur in proper fabrication of building parts.
  - 2. Will not chalk in excess of ASTM D4214 Number 8 rating, determined by procedure outlines in ASTM D4214.

### 1.11 MAINTENANCE SERVICE

- A. Maintenance: Beginning at Substantial Completion, provide [12] months' full maintenance by skilled employees of automatic entrance door Installer. Include bi-annual planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.
- B. Perform maintenance, including emergency callback service, during normal working hours.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Preferred Manufacturers:
- B. "Unislide OHC Series [Bi-Parting] [Single-Slide]"; Besam, An Assa Abloy Group Company (866-237-2687)
  - 1. Exterior: "Unislide OC-S"
  - 2. Interior: "Unislide OC-A" with Access Control Package
  - 3. Approved Manufacturers:
- C. "Dura-Glide, Series 2000, Bi-Parting"; Stanley Access Technologies LLC, Security Solutions Product Group (860-677-2861)
  - 1. Exterior: "Model 7-2260"
  - 2. Interior: "Model 7-2260"
- D. "Dura-Glide, Series 3000 - Single-Slide"; Stanley Access Technologies LLC, Security Solutions Product Group (860-677-2861)
  - 1. Exterior: "Model 313834"
  - 2. Interior: "Model 313834"

- E. "Series 2003 Belt Drive, Bi-Parting"; Horton Automatics, Division of Overhead Door Corporation (800-531-3111)
  - 1. Exterior: "Type 310, Model O-X-X-O"
  - 2. Interior: "Type 310, Model O-X-X-O"
- F. "Series 2003 Belt Drive, Single-Slide"; Horton Automatics, Division of Overhead Door Corporation (800-531-3111)
  - 1. Exterior: "Type 310, Model O-SX,SX-O"
  - 2. Interior: "Type 310, Model O-SX,SX-O with optional muntin"

## 2.02 AUTOMATIC SLIDING ENTRANCE SYSTEM

- A. System shall consist of sliding aluminum doors and sidelights, header, operator, cylinders, actuating controls, and directional motion sensors.
- B. Exterior: Model as shown above with half-beveled threshold.
- C. Interior: Model as shown above with electronic access control fail secure lock, panic exit device on active door leaves [and surface mounted threshold]. Provide manufacturer's standard switch to allow an exit only "night-time" mode to engage the electronic access lock system.
  - 1. Automatic Sliding Door System: The system shall consist of sliding aluminum doors, sidelights, header, operator, and actuating controls. All components shall be factory assembled in the header, adjusted and tested.
  - 2. Sliding Aluminum Doors: Provide door units to dimension heights and widths with corresponding glazing as shown on Drawings with standard narrow stile. Door holders shall be provided for all panels to control the doors as they swing in the direction of egress. All door panels shall have security glass stops. All doors shall have intermediate rails. The bi-part sliding door system shall include a two-point lock securing the lead edges of the door stiles together and to the hanger assembly.
  - 3. Door Operation: Shall be [single slide] [bi-parting] directional operation. In compliance with NFPA 101, the sliding door panels shall allow "breakout" to the full open position to provide instant egress at any point in the door's movement. To allow safe egress, automatic operation shall be discontinued when the sliding panel is in the "breakout" mode. Doors and sidelights shall be sized to prevent pinch points at meeting stiles.
- D. Emergency Breakaway Capability: [Sliding leaves only] [Sliding leaves and sidelites]
- E. Safety Search Circuitry: Shall be provided which will recycle the doors when an object is encountered during the closing cycle. The circuitry shall search for that object on the next closing cycle by reducing the door speed at the position the object was previously encountered, and will continue to close in check speed until the doors are fully closed, at which time the doors will reset to normal speed. If the obstruction is encountered again, the doors shall come to a full stop. The door shall remain stopped until the obstruction is removed and an operate signal is given, resetting the door to its normal speed.
- F. The doors shall be provided with a "Fail-Secure Electric Carriage Lock" in the header to prevent the doors from sliding in the night mode. This device shall not interfere with emergency breakout function.
  - 1. The doorway presence-sensing device shall be the "BEA Wizard Threshold" by Besam, "STAN-GUARD Threshold Sensor" by Stanley, or "Optional Sensor with added threshold scan", by Horton. The sensor shall be factory-installed to the underside of the header. The interior door sensing device shall be disabled (night mode) by a key switch furnished by others and installed by Division 08 71 00 (08710).
  - 2. Interior Door to be activated during night-mode by remote card reader or push button override located at the front desk furnished by Others. Refer to Section 08 71 00 (08710).
  - 3. Glazing: Refer to Section 08 80 00 (08800). Match adjacent storefront system

## 2.03 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

- C. Sheet and Plate: ASTM B209.
- D. Welding Rods and Bare Electrodes: AWS A5.10.
  - 1. Glazing: Refer to Section 08 80 00. Match adjacent storefront system.
  - 2. Sealants and Joint Fillers: Refer to Section 07 92 00 "Joint Sealants."
  - 3. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil thickness per coat.

## **2.04 COMPONENTS**

- A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.
- B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch-thick glazed doors with minimum 0.125-inch-thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
- C. Sidelites: Manufacturer's standard 1-3/4-inch-deep sidelites with minimum 0.125-inch-thick, extruded-aluminum tubular stile and rail members matching door design.
- D. Headers: Fabricated from minimum 0.125-inch-thick extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
- E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
- F. Threshold: Manufacturer's standard threshold members and bottom-guide track system, with stainless-steel ball-bearing-center roller wheels.
- G. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- H. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- I. Emergency Breakaway Sign: ANSI/BHMA A156.10; red background with 1-inch high contrasting letters with the words "IN EMERGENCY PUSH TO OPEN."

## **2.05 FABRICATION**

- A. General: Fabricate automatic entrance door system components to designs, sizes, and thicknesses specified and to comply with indicated standards.
- B. Prefabrication: Provide automatic entrance doors as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
- C. Do not drill and tap for surface-mounted hardware items until time of installation at Project site.
- D. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metalwork in manner that prevents damage to exposed finish surfaces. For hardware, perform these operations before applying finishes.
- E. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- F. Prepare components to receive concealed fasteners and anchor and connection devices.
- G. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

## 2.06 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Color: Refer to Exterior Finish Index.
  - 1. Liquid Coating System: All exposed aluminum surfaces shall have a manufactured-applied, Ten (10) year warrantied, AAMA 2604, two (2)-coat, Liquid Fluoropolymer coating not less than 50% polyvinylidene fluoride resin (PVDF) by weight finish, free from blemishes and surface defects. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Liquid Coating System: All exposed aluminum surfaces shall have a manufactured-applied, [Ten (10)] [Twenty (20)] year warrantied, AAMA 2605, two (2)-coat for solid colors, or three (3) coat for metallics, Liquid Fluoropolymer coating not less than 70% polyvinylidene fluoride resin (PVDF) by weight finish, free from blemishes and surface defects. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - a. Pretreatment: A chromium chromate or chromium phosphate coating weight range is required between 80-120 mg/ft<sup>2</sup> as measured by x-ray fluorescence (XRF) per ASTM D5723.
    - b. Primer: Liquid Chromate primer under liquid topcoats.

**SECTION 08 51 13**  
**ALUMINUM WINDOWS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Operating and Fixed Aluminum Window Units
    - a. Horizontal Sliding Units
    - b. Horizontal Sliding Units Above Louver in Integral Master Frame.
      - 1) Louvers to be provided by Window Manufacturer
  - 2. Perimeter Sealant
  - 3. Glass and Glazing
  - 4. Wood Blocking, Shims, Anchors, Clips, and all accessories necessary for a complete installation.
  - 5. All Aluminum Trim and Closure Pieces
  - 6. All Operable Window and Door Hardware

**1.02 REFERENCES**

- A. The Aluminum Association (AA)
  - 1. "Aluminum Design Manual 2000: Specifications for Aluminum Structures"
- B. American Architectural Manufacturers Association (AAMA) Publications:
- C. 611 "Voluntary Specification for Anodized Architectural Aluminum"
  - 1. 1503 "Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections"
  - 2. 2400 "Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction"
  - 3. 2604 "Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels"
  - 4. 2605 "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels"
- D. American National Standards Institute (ANSI) Publications:
  - 1. ICC A117.1-2009 "Accessible and Useable Buildings and Facilities"
  - 2. Z97.1 "Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings"
- E. Americans with Disabilities Act (ADA)
- F. ASTM International (ASTM) Publications:
  - 1. C1036 "Standard Specification for Flat Glass"
  - 2. C1048 "Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass"
  - 3. E90 "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"
  - 4. E283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen"
  - 5. E330 "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
  - 6. E331 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference"
  - 7. E413 "Classification for Rating Sound Insulation"
  - 8. E547 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference"
  - 9. E774 "Standard Specification for Sealed Insulating Glass Units"

10. E1886 "Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
  11. E1996 "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
  12. F588 "Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact"
- G. Glass Association of North America (GANA)
1. "GANA Glazing Manual"
- H. Federal Specifications (FS) Publications:
1. FS-RR-W-365A "Wire Fabric (Insect Screening)"
- I. Insulating Glass Certification Council (IGCC)
- J. Insulating Glass Manufacturers Alliance (IGMA) Publications:
1. Glazing Guidelines
- K. National Fenestration Rating Council (NFRC)
- L. Screen Manufacturers Association (SMA) Publications:
1. 1004 "Specifications for Aluminum Tubular Frame Screens for Windows"
- M. U.S. Consumer Product Safety Commission (CPSC) Publications:
1. 16 CFR Part 1201 "Safety Standard For Architectural Glazing Materials"
- N. Window and Door Manufacturers Association (WDMA) Publications:
1. ANSI/AAMA/WDMA 101/I.S.2/NAFS-02 "Voluntary Performance Specification for Windows, Skylights and Glass Doors"
  2. AAMA/WDMA/CSA 101/I.S.2/A440-08 "Standard/Specification for Windows, Doors and Unit Skylights"

### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 indicating specified items selected for use in project with the following supporting data.
1. Product data for each type of aluminum window specified, including standard construction details, dimensions of individual components, profiles, finishes, hardware, and accessories.
  2. Shop drawings for each type of window specified, including 1/4-inch scale wall elevations, typical unit elevations at 3/4 inch scale glazing details, full-size details of typical composite members and the following:
    - a. Panning Details.
    - b. Flashing and drainage details.
    - c. Mullion details, including reinforcement and stiffeners.
    - d. Joinery details.
  3. Samples: Provide full-size or partial-size sample of window illustrating glazing system, quality of construction and finish.
    - a. Hardware: Full-size units with factory-applied finish.
  4. Product certificates signed by the window manufacturer certifying that window units comply with specified performance requirements.
  5. Coordinate with Section 08 75 16 as required to comply with Accessibility Requirements.

### 1.04 DEFINITIONS

- A. Performance grade number, included as part of the AAMA/WDMA/CSA 101/I.S.2/A440-08 product designation code, is the actual design pressure in pounds force per square foot used to determine structural test pressure and water test pressure.



## 1.05 QUALITY ASSURANCE

- A. All window units shall be manufactured by a single source.
  - 1. All windows in any one project must be by the same manufacturer and with comparable frame depth, profile, glazing bite and installation requirements. Manufacturer must provide a window system that can incorporate all window configurations used on the project.
    - a. Sections 08 41 13, 08 51 13, and 08 80 00 to be furnished by single source insuring product compatibility and coordination.
  - 2. Standards: Requirements for aluminum windows, terminology and standard of performance, and fabrication workmanship are those specified and recommended in AAMA/WDMA/CSA 101/I.S.2/A440-08 and The Aluminum Association (AA).
    - a. All window units shall be labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440-08. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA 101/I.S.2/A440-08.
    - b. All testing shall be conducted using AAMA/WDMA/CSA 101/I.S.2/A440-08 Gateway Performance minimum specified test sizes.
  - 3. Provide aluminum windows of the performance class and grade indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440-08.
- B. Certify that windows have been tested in accordance with American Architectural Manufacturers Association (AAMA/WDMA) Specification for Performance Class specified complying with the following performance standards:
  - 1. AAMA/WDMA/CSA 101/I.S.2/A440-08 Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440-08.
    - a. Performance Class: CW
    - b. Performance Grade: [35] [40] [45]
    - c. Exception to AAMA/WDMA/CSA 101/I.S.2/A440-08: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length [or 3/4 inch, whichever is less,] at design pressure based on the following:
      - 1) Testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440-08, Uniform Load Deflection Test.
  - 2. Uniform Structural Properties (ASTM E330): Pressure acting inward and outward. Window to be operable and maximum .4% permanent deformation, per member, when tested at a static air pressure difference of the following:
    - a. Class CW-45: 67.5 PSF
    - b. Class CW-40: 60.0 PSF
    - c. Class CW-35: 45.0 PSF
  - 3. Water Resistance (ASTM E331 and ASTM E547): No water penetration at test pressures indicated.
    - a. Class CW-45: 6.75 PSF
    - b. Class CW-40: 6.00 PSF
    - c. Class CW-35: 4.50 PSF
  - 4. Air Leakage (ASTM E283):
    - a. Sliding Windows: Maximum 0.37 CFM per sq./ft. of total exterior surface area, when tested at a static air pressure difference of 1.57 PSF minimum .
    - b. Fixed Windows: Maximum 0.15 CFM per sq. ft. of total exterior surface area, when tested at a static air pressure difference of 1.57 PSF minimum.
    - c. Forced Entry Resistance (ASTM F588): To performance level 10.
- C. Accessibility:
  - 1. Conform to [2010 ADA Standards] [ANSI ICC A117.1-2009] [insert governing code] for positioning requirements for the Disabled.

2. Operation of Operable Parts: The maximum force for pushing or pulling open windows in Accessible Rooms shall be [5] pounds in accordance with [2010 ADA Standards] [ANSI ICC A117.1-2009] [insert governing code].
  3. Assistive Window Actuator: For operable windows located in rooms that are required to meet ADA guidelines provide Assistive Window Actuators as specified in Section 08 75 16.
- D. Sound-Insulation Construction: Provide window units certified to provide a Sound Transmission Class (STC) rating of at least values shown below when tested according to ASTM E90 and classified according to ASTM E 413.
1. All Fixed and Operable Window Units: STC- [Insert value].
- E. Hurricane Missile Impact Protection: Provide window units certified to comply with the [2009] [2012] [2015] International Building Code, Section 1609.1.4, ASTM E1996 and ASTM E1886 and with one of the following:
1. Glazed Openings located within 30 feet of grade shall meet the requirements of the Large Missile Test of ASTM E1996.
  2. Glazed Openings located more than 30 feet above grade shall meet the requirements of the Small Missile Test of ASTM E1996.
  3. Current Miami-Dade County Protocols: PA 201, 202 and 203 (as applicable).
    - a. Low-Missile Impact Rating, 120 psf wind speed.
  4. Hurricane Missile Impact Protection shall be provided for all exterior glazed openings, including windows, doors, and storefronts.
  5. Each unit shall bear a permanent label with the manufacturer's name or logo, city, state and the following statement: "Hurricane Missile Impact Protection Approved" followed by the code agency test method (i.e. "Dade County Product Control Approved")
- F. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
1. Safety Glazing Products: Comply with testing requirements in CPSC 16 CFR Part 1201.
    - a. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
  2. Insulating glass shall comply with standard for construction and insulating value as established by:
    - a. Insulating Glass Manufacturers Alliance (IGMA).
    - b. Insulating Glass Certification Council (IGCC)
  3. Glazing and Sealant: Per manuals published by the Flat Glass Marketing Association (FGMA). Glazing and sealant to match approved colors for all aluminum framing.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Transportation and Handling: Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging. Provide equipment and personnel to handle products by method to prevent soiling or damage. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- B. Storage and Protection: Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain with temperature and humidity ranges required by manufacturer's instruction.

## **PRODUCTS**

### **2.01 MATERIALS**

- A. Window Units:
  1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:

- a. Traco, A Division of Kawneer, a part of Alcoa Building & Construction Systems (800-837-7002)
  - 1) Horizontal Sliding: TR-6400 Series
  - 2) Fixed Units: TR-7400 Series
  - 3) Quaker Window Products Company, Inc. (800-347-0438)
    - (a) Horizontal Sliding: "Series"
    - (b) Fixed: "DS Series"
  - 4) Wojan Window and Door Corporation (800-632-9827)
    - (a) Horizontal Sliding: "M-85 Series"
    - (b) Fixed: "M-85 Series"
  - 5) Traco, A Division of Kawneer, a part of Alcoa Building & Construction Systems (800-837-7002)
    - (a) Horizontal Sliding Unit over Louver: TR-6400 Series Slider over Louver
    - (b) Fixed Units: TR-7400 Series
  - 6) Quaker Window Products Company, Inc. (800-347-0438)
    - (a) Horizontal Sliding Unit over Louver: "K200 SL Series Slider over Louver Series"
    - (b) Fixed Units: "K200 DS Series"
  - 7) Wojan Window and Door Corporation (800-632-9827)
    - (a) Horizontal Sliding Unit over Louver: "M-85 Series"
    - (b) Fixed Units: "M-85 Series"
- B. All fasteners, tools, equipment, and other materials necessary for a complete installation shall be furnished by this Contractor.
  1. Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with all window members, cladding, trim, hardware, anchors, and other components
- C. Insect Screens: Provide removable insect screen panel for each moveable glazed sash.
  1. Screen Fabric: 18 by 16 mesh of 0.013" diameter aluminum wire. Comply with FS-RRW-365, Type VII, except black anodized or "gun metal" coating on wire.
  2. Screen Frame: Provide formed or extruded aluminum frames and removable vinyl fabric-retainer spline.
    - a. Finish shall match window.
- D. Louvers
  1. Aluminum louvers to be furnished and installed glazed within integral master frame of window units where shown on Drawings. Louver free area to be coordinated with mechanical PTAC units supplied by Division 23.
    - a. Fixed Blade Angle: 42 degrees
    - b. Provide PTAC Collar
    - c. Provide 0.032 inch aluminum sheet blank-off panels with 1" insulation on each side of PTAC unit on rear side of louver.
    - d. Finish: Match Windows
- E. Accessories:
  1. Safety Device Stops: For operable windows, provide stops to prevent opening greater than 4". Stops shall be constructed of stock window frame, or durometer material and attached with tamper-resistant screw.
    - a. If local code requires window units to open fully, provide the following:
      - 1) "Charlie-Bar" security device by Charles Bar-Lok Corp. (708-333-0071).
      - 2) Size to fit window opening, [Aluminum] [Bronze] finish.
  - 2.
  3. Sills: Manufacturer's standard exterior sills [with slide in nailing fin,] type as shown on Drawings.
    - a. [Nailing fin: manufacturer's standard nailing fin.]

- b. [Sill Flashing: Manufacturer's standard snap-on sill flashing for use with EIFS exterior finishes.]
- 4. [Trim: Manufacturer's standard interior snap trims, type as shown on Drawings.]
- 5. [Head Flashing: Manufacturer's standard head flashing for use with EIFS exterior finishes.]
- 6. Coordinate with Metal Shadow Box perimeter components provided by others.
- 7. 6.
- 8. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- F. Hardware:
  - 1. Sash lock: Manufacturers' standard.
  - 2. Wheels and Sliding Mechanism: Manufacturer's standard.
- G. Maximum operating force: once sash in motion:
  - 1. Horizontal Sliding Windows: 20 LBF
- H. Operating sash in guest rooms to be located closest to center of room.

## 2.02 GLASS MATERIALS

- A. Glass [I]: Clear Float Glass: ASTM C1036, Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), as manufactured by one of the following:
  - 1. Approved Manufacturers:
    - a. PPG Industries Inc., Glass Group (800-377-5267)
    - b. Pilkington North America (800-221-0444)
    - c. AFG Industries, Inc. (800-251-0441)
    - d. Old Castle Glass, a CRH Company (800-899-8455)
    - e. Viracon, Inc. (800-533-2080)
    - f. Guardian Industries, (248-340-1800)
    - g. Approved Substitution by Window Manufacturer.
- B. Glass [II]: Tempered Glass: Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3, clear, fully tempered safety glass (meet requirements of ANSI Z97.1).
  - 1. All tempered glass shall conform to ASTM C1048, ANSI Z97.1, and CPSC 16 CFR Part 1201. Tempered glass shall bear permanent monogram indicating tempered quality. Fabrication marks on tempered glass shall be located to be concealed in completed installation.
  - 2. Color: Clear to match aluminum windows glazing, Section 08 51 13.
- C. Glass [III]: Coated Low Emissivity Glass: Condition C (other coated glass), Type I (transparent glass, flat), Class I (clear), Quality q3 (glazing select), with coating type and performance characteristics complying with requirements specified below:
  - 1. Low E Coating: Side [2] [3] on insulated units.
  - 2. Approved Manufacturers:
    - a. "Sungate 500 Low-E Glass"; PPG Industries Inc., Glass Group (800-377-5267)
    - b. "Energy Advantage Low-E"; Pilkington North America (419-247-3201)
    - c. "Comfort E2"; AFG Industries, Inc. (800-251-0441)
    - d. Approved Substitution by Window Manufacturer.
- D. Windows shall be glazed as follows:
  - 1. Insulating Glass: Manufacturer's [standard] low "E" units consisting of manufacturer's special design to conform to required STC and thermal ratings, as approved by the Architect.
    - a. Provide preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E774 for

performance classification indicated as well as with other requirements specified for glass characteristics, air, space, sealing system, sealant, space material, and desiccants.

- 1) Total Thickness: [5/8"] [1"].
- 2) Thickness of Each Pane: [1/4"].
- 3) Air Space Thickness: [3/8"] [1/2"].
- 4) Thermal Performance (Full Frame Performance): Minimum Winter U-Value: [0.42]
- 5) Exterior Pane of Glass: Glass Type [I] [or] [II]
  - (a) Provide Tempered Glass where shown on Drawings and as required by local Codes and Ordinances.
- 6) Sealing System: Manufacturer's Standard Dual Seal
  - (a) Desiccant: Manufacturer's Standard - Either Molecular Sieve or Silica Gel or Blend of Both
  - (b) Spacer Material: Manufacturer's Standard Metal, with [Clear Anodized Finish] [Bronze Anodized Finish].

## **2.03 JOINT SEALANTS - FRAMING SYSTEM**

- A. For metal to metal joints use Manufacturer's standard, recommended by manufacturer for joint type, color to match finish of aluminum to which applied.
- B. For perimeter of framing members, refer to Section 07 92 00 - Joint Sealants.

## **2.04 FABRICATION**

- A. Fabricate windows allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.
- B. Rigidly fit joints and corners. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant.
- C. Develop drainage holes with moisture pattern to exterior.
- D. Prepare components to receive anchor devices. Fabricate anchorage items.

## **EXECUTION**

### **3.01 INSTALLATION - GENERAL**

- A. Installation Details: Before proceeding with the manufacturing of the windows and doors, the Window Contractor shall submit complete installation details for approval by the [Architect] [Owner's Representative]. These Drawings shall show elevations of windows, full-sized details of all sections of windows, collateral materials and details of anchorage. Supplemental data shall contain calculations of moments of inertia on frames and mullion connections plus instructions for storage, handling, and erection of windows and sliding doors. Conform to AAMA 2400 for Nail Fin Installation.
- B. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.
- C. Beginning of installation means acceptance of existing conditions.
- D. Align window frame plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
- E. Coordinate attachment and seal of air and vapor barrier materials. Install under sill flashings, if required.
- F. Pack fibrous insulation in shim spaces at perimeter to maintain continuity of thermal barrier.
- G. Install perimeter sealant, backing materials, and installation requirements in accordance with Section 07 92 00 (07920). Apply sealant to ends of sill for watertight seal.
- H. Windows shall be installed by experienced workmen in exact accordance with the manufacturer's instructions and approved Shop Drawings.
- I. Erection Tolerances:

1. Maximum deviation from established vertical or horizontal reference lines:
    - a. 1/8 inch per 12 feet of length of any member.
    - b. 1/4 inch in any continuous run.
  2. Maximum offset from true alignment between two adjoining members in line, end to end, 1/16 inch.
- J. Adequately anchor frames to surrounding construction. Place anchors at 2'-0" on center maximum or as required to maintain position of frames when subjected to thermal and building movement and specified wind load.
1. Anchorage method to be integral nailing fin. Alternate anchoring methods will not be acceptable.

### **3.02 ADJUSTING AND CLEANING**

- A. After completion of window installation, windows shall be inspected, adjusted, put into working order and left clean, free of labels, dirt, etc. Protection from this point shall be responsibility of General Contractor.
- B. Remove protective material from prefinished aluminum surfaces.
- C. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

**END OF SECTION**

**SECTION 08 71 00**  
**DOOR HARDWARE**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. All the finish hardware including all screws, bolts, and other devices required to complete the work.
  - 2. Lock cylinders for locks specified in other Sections.
  - 3. Miscellaneous hardware.
  - 4. Hardware furnished for shop or factory installation on doors and frames.
  - 5. Keys and Keying.
- B. Related Sections:
  - 1. Section 08 11 13 (08110) - Steel Doors and Frames
  - 2. Section 08 14 00 (08200) - Wood Doors
  - 3. Section 08 41 13 (08410) - Aluminum-Framed Entrances and Storefronts
  - 4. Section 25 51 10 - Integrated Automation Control of Guestroom Equipment
  - 5. Division 26 (16) Sections - Coordination with items requiring electrical connections.

**1.02 REFERENCES**

- A. Perform all work in accordance with the following:
  - 1. American National Standards Institute (ANSI) Publications:
    - a. ICC A117.1-2009 "Accessible and Useable Buildings and Facilities"
    - b. ANSI/BHMA A 156.1 "Butts & Hinges"
    - c. ANSI/BHMA A 156.2 "Bored and Preassembled Locks and Latches"
    - d. ANSI/BHMA A 156.3 "Exit Devices"
    - e. ANSI/BHMA A 156.4 "Door Controls - Closers"
    - f. ANSI/BHMA A 156.5 "Auxiliary Locks and Associated Products"
    - g. ANSI/BHMA A 156.6 "Architectural Door Trim"
    - h. ANSI/BHMA A 156.13 "Mortise Locks & Latches"
    - i. ANSI/BHMA A 156.17 "Self-Closing Hinges & Pivots"
    - j. ANSI/BHMA A 156.18 "Materials & Finishes"
    - k. ANSI/BHMA A 156.21 "Thresholds"
    - l. ANSI/BHMA A 156.22 "Gasketing and Edge Seal Systems"
    - m. ANSI/BHMA A 156.23 "Electromagnetic Locks"
    - n. ANSI/BHMA A "156.25 Electrified Locking Devices"
    - o. ANSI/BHMA A 156.26 "Continuous Hinges"
    - p. ANSI/BHMA A 156.28 "Keying Systems"
  - q. ANSI/DHI Publications:
    - 1) ANSI/DHI A115.1G "Installation Guide for Doors and Hardware"
  - r. Builders Hardware Manufacturers Association (BHMA)
  - s. Door and Hardware Institute (DHI) Publications:
    - 1) DHI-WDHS-3 "Recommended Hardware Locations for Wood Flush Doors"
    - 2) "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames"
  - t. National Fire Protection Association (NFPA) Publications:
    - 1) 80 "Standard for Fire Doors, Fire Windows"
    - 2) 101 "Life Safety Code"
    - 3) 252 "Standard Methods of Fire Tests of Door Assemblies"
  - u. Underwriter's Laboratories, Inc. (UL) Standards
    - 1) 10B "Standard for Fire Tests of Door Assemblies"
    - 2) 10C "Positive Pressure Fire Tests of Door Assemblies"
    - 3) 305 "Panic Hardware"
  - v. Window and Door Manufacturers Association (WDMA)

- B. Regulatory Requirements:
1. Conform to NFPA 80, and other applicable codes for requirements applicable to fire rated doors and frames.
  2. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., and acceptable to the public authority as suitable for the purpose specified and indicated.
  3. Conform to requirements of ADA (Americans with Disabilities Act)
  4. Accessibility: Hardware for doors used by the disabled shall comply with all state and local codes which shall supersede this Section. [Notify the Architect] [Owner's Representative] of conflicts between regulations and this specification prior to providing hardware.
    - a. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
    - b. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
1. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
  2. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
      - 1) Type, style, function, size, and finish of each hardware item.
      - 2) Name and manufacturer of each item.
      - 3) Fastenings and other pertinent information.
      - 4) Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule. Submittals shall use the same designations for door and hardware numbers as shown on the Drawings.
      - 5) Explanation of all abbreviations, symbols, and codes contained in schedule.
      - 6) Mounting locations for hardware.
      - 7) Door and frame sizes and materials.
      - 8) Keying information.
    - b. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
    - c. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
    - d. 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.

C. A.

### 1.04 QUALITY ASSURANCE

- A. 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 at reasonable times during the course of the work, for consultation about Project's hardware requirements.

1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.
  2. The Guest Room security system shall be installed by a Contractor certified by the manufacturer of the system.
  3. Hardware supplier for Guest Room security system shall provide supervision during installation as well as training for Courtyard personnel prior to opening of facility.
- B. Fire-rated Openings: Provide door hardware for fire-rated openings that complies with NFPA 80, based on testing per NFPA 252, and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriter's Laboratories, Inc. (UL), Warnock Hersey, ETL SEMKO division of Intertek (WHI), FM Global (FMG), or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.
1. Comply with the requirements of the International Building Code with testing in accordance with UL 10C for positive pressure door test.
    - a. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
    - b. Doors shall be labeled to certify compliance.
    - c. Provide installation instructions attached to each door in a manner that assures availability to the installer and building official.
- C. Accessibility
1. All work shall conform to the [2010 ADA Standards] [ANSI ICC A117.1-2009] [insert governing code].
  2. Opening Force: The maximum force for pushing or pulling open doors shall be [5] pounds in accordance with [2010 ADA Standards] [ANSI ICC A117.1-2009] [insert governing code].
- D. Inspection: General Contractor shall provide in writing to [Architect] [Owner's Representative] an inspection of all doors and frames for conformance to specifications. Inspection shall include checking for fit tolerance plumb and level as well as proper hardware and operation.

#### **1.05 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.

#### **1.06 CERTIFICATIONS**

- A. Conform to governing Building Codes for requirements applicable to the work specified herein.
- B. Conform to NFPA 101 with regard to requirements for fire-rated doors and frames.
- C. Hardware for doors in accessible locations as defined by the Americans with Disability Act (ADA) shall comply with all state and local codes which shall supersede this section. The [Architect] [Owner's Representative] shall be notified of any conflicts between regulations and the specifications prior to the purchase and installation of any hardware.

#### **1.07 SCHEDULING**

- A. Reinforcement for all hardware for metal doors and frames shall be installed at the factory and be made to template and furnished with machine screws. The face of locks shall be beveled to match the bevel edge of metal doors. All hardware for the metal doors shall be ordered as soon as possible after the Contract is awarded.

## **1.08 DELIVERY, STORAGE AND HANDLING**

- A. Legibly mark and label each package, indicating item and location for which it is intended. Each marking shall correspond to the number shown on the approved hardware schedule. Each package shall contain all the required screws, bolts and fasteners necessary for installation of each hardware item.
  - 1. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
  - 2. Include basic installation instructions with each item or package.
- B. Construction keys: Tagged and plainly marked on face of envelope with the key change number, door designation and all other required information and mailed directly to the Owner.
- C. Permanent keys: Identified by lock manufacturer and opening to which they apply. Lock manufacturer shall place each set of keys into an envelope and label same with door numbers for rooms or areas. Mark boxes of keys with project name and location and ship Change Keys, Master Keys, and Grandmaster Keys via prepaid registered mail to Owner.
- D. Guest Room Security Systems: Guest room card keys, master keys, and maids keys to be keyed in accordance with instructions provided by Owner's Loss Prevention Technical Service Department.

## **1.09 SPARE MATERIALS**

- A. Refer to Section 01 78 43 (01790)

## **1.10 WARRANTY**

- A. Furnish a written guarantee which shall cover the periods stated below from and after the completion of the building and its acceptance by the Owner.
- B. For a period of one (1) year after final acceptance by the Owner. Hardware failing to comply with warranty shall be removed and replaced with new material including labor at no cost to Owner.
- C. Provide the following special warranties starting from the date of substantial completion:
  - 1. Door Locksets: Two (2) years.
  - 2. Computer Systems: Two (2) Years .
  - 3. Card Readers and other electrical equipment: Two (2) years.

## **PRODUCTS**

### **2.01 DISTRIBUTORS**

- A. Avendra, LLC Preferred Distributors:
  - 1. Contract Hardware, Inc. (800-266-3418)
    - a. Contact: Mark Tew

### **2.02 MANUFACTURERS**

- A. Hardware manufacturers are specified for each hardware item to establish a standard of quality and minimum functional requirements. In the hardware schedule at the end of this Section, product model numbers are used as part of this description to assist in identifying individual items.
- B. Items of a particular hardware category, i.e., locksets, closers, hinges shall be of the same manufacturer.
- C. Preferred Manufacturers:
  - 1. None
- D. Approved Manufacturers and Abbreviations:

1.	ABH	<u>Architectural Builders Hardware Mfg., Inc.</u>	(630-875-9900)
2..	ARM	<u>Adams Rite Manufacturing Co., An ASSA ABLOY Group Company</u>	(800-872-3267)
3.	AIP	<u>Aiphone Corporation</u>	(800-692-0200)
4.	CBL	<u>Charles Bar-Lok Corp.</u>	(708-333-0071)
5.	DE	<u>Detex Corp.</u>	(800-729-3839)
6.	DCI	<u>Door Controls International</u>	(800-742-3634)
7.	DOR	<u>DORMA Americas</u>	(800-523-8483)
8.	EDL	<u>J. G. Edelen Company, Inc.</u>	(410-918-1200)
9.	FAS	<u>Folger Adam EDC, An ASSA ABLOY Group Company</u>	(800-260-9001)
10.	HAG	<u>Hager Companies</u>	(800-255-3590)
11.	HES	<u>HES, An ASSA ABLOY Group Company</u>	(800-626-7590)
12.	IVES	<u>Ives, an Allegion Brand</u>	(888-758-9823)
13.	JOH	<u>Johnson Hardware</u>	(800-837-5664)
14.	LCN	<u>LCN Closers, an Allegion Brand</u>	(888-758-9823)
15.	MCK	<u>McKinney Products Company, An ASSA ABLOY Group Company</u>	(800-346-7707)
16.	NGP	<u>National Guard Products, Inc. (NGP)</u>	(800-647-7874)
17.	NOR	<u>Norton Door Controls, An ASSA ABLOY Group Company</u>	(800-438-1951)
18.	PDQ	<u>PDQ Manufacturing</u>	(800-441-9692)
19.	PEM	<u>Pemko Manufacturing Company, an ASSA ABLOY Group Company</u>	(800-283-9988)
20.	PRE	<u>Precision Hardware, Stanley Security Solutions, Inc</u>	(317-849-2250)
21.	PUL	<u>JAI PULNiX America, Inc.</u>	(800-445-5444)
22.	RIX	<u>Rixson Specialty Door Controls An ASSA ABLOY Group Company</u>	(800-457-5670)
23.	RO	<u>Rockwood Manufacturing Co., An ASSA ABLOY Group Company</u>	(800-458-2424)
24.	SAF	<u>Saflok, a Kaba Group Company</u>	(800-999-6213)
25.	SAR	<u>Sargent Manufacturing Co., An ASSA ABLOY Group Company</u>	(800-727-5477)
26.	SCH	<u>Schlage, an Allegion Brand</u>	(888-758-9823)
27.	SCE	<u>Schlage Electronics, an Allegion Brand</u>	(888-758-9823)
28.	SIM	<u>SimplexGrinnell, A Tyco Company</u>	(800-746-7539)
29.	STA	<u>Stanley Commercial Hardware</u>	(860-225-5111)
30.	TEL	<u>Telkee, Inc</u>	(800-950-3226)
31.	TLM	<u>Tell Manufacturing, Inc</u>	(800-433-4047)
32.	TRM	<u>Trimco/BBW</u>	(323-262-4191)
33.	VDI	<u>Von Duprin, an Allegion Brand</u>	(888-758-9823)
34.	YAL	<u>Yale Commercial Locks &amp; Hardware, An ASSA ABLOY Group Company</u>	(800-438-1951)

## 2.03 GENERAL REQUIREMENTS

### A. Electronic Security System Description

#### 1. General:

- a. Install a network ready electronic lock system, complete and including without limitation, the following components:
- b. Lock Technology: RFID (radio-frequency identification), proximity activated, network ready.
  - 1) Mobile Key Certified Model with Blue Tooth Low Energy (BLE) proximity activated lock is required.
- c. Approved Manufacturers:
  - 1) "MT RFID x BLE Lock x Troy Lever"; Saflok, a Kaba Group Company (800-523-9605)
    - (a) "Provide Auto Deadbolt Option (ADB) at all Guestroom Entry Doors

- 2) No Substitutions
- d. Guest Room Locking System, Front Desk System
  - 1) Preferred Manufacturers:
    - (a) None
  - 2) Approved Manufacturers:
    - (a) Basis-of-Design Product: Subject to compliance with requirements, provide "System 6000" by Saflok, a Kaba Group Company, or one of the following:
    - (b) No Substitutions
  - 3) Microprocessor based Front Desk Controller System shall be a PC based network RFID encoding, handheld unit with lock integration (LPI) feature. Include the following:
    - (a) Main PC Base computer, RS232 Cable and support hardware.
    - (b) [2][1] Each Network RFID keycard encoder station and power supply.
    - (c) 1 Each Basic System Items: Manuals, etc.
    - (d) 1 Each System Printer with Serial Cable
    - (e) Keycards: Generic reusable plastic RFID keycards. Quantity: 2000.
  - 4) System shall be designed for the following features:
    - (a) Password access to front desk system
    - (b) Transaction log of last 4,000 transactions
    - (c) Simple three-step check in progress
    - (d) Encoder must encode and validate cards
    - (e) Encoder must be able to "read a card"
    - (f) Fail-safe key cards in case of catastrophic power failure
    - (g) Handheld Unit: Password protected and be able to program up to 50 locks. In addition HHU associated with the Front Desk System. This unit will be used for lock interrogation, diagnostics and programming. Program shall include:
      - (1) Set time clock
      - (2) Perform diagnostic check
      - (3) Interrogate up to last 100 entries: time, date and card identification
  - 5) Guest Room: Locks shall be opened by a correctly coded card, upon placement of card on RFID reader. Use of a newly issued card shall automatically re-key the lock to void the previous card, and guest cards shall additionally self-cancel by date and time automatically. Perimeter door reader to allow authorized guest cards. Canceled cards must not access perimeter reader.
    - (a) Audit trail in lock of last 100 entries - time, date, and card identification
    - (b) Office/passage function by card for offices, entry doors or hospitality suites
    - (c) Reusable ABA or ISO 14443 standard Mifare RFID cards
    - (d) Three (3) or Four (4) standard AA batteries or a Four (4) AA battery pack
    - (e) Non-volatile memory lock will not lose program even if the batteries are removed
    - (f) Four (4) levels of master/staff cards; 50 masters per level
    - (g) Staff cards shall be individualized to identify individual card holder via lock audit
    - (h) All cards are time limited
    - (i) For Finish and Lever design see hardware sets
    - (j) Deadbolt override cards for emergency level.
    - (k) Simultaneous retraction of deadbolt and latchbolt (1" steel dead bolt with security pins and 3/4" anti-friction latch bolt).
    - (l) Intelligent power shutdown feature. Batteries remain deactivated until keycard is inserted. Master level card key will activate a flashing LED "Low Battery" light warning system 30 days in advance of battery failure.
    - (m) Mortise lockset to conform to BHMP Grade One, and meet UL Fire Rating A (3-Hour) through C (3/4-Hour).
    - (n) Exterior door applications shall have special weather protection stand.

- (o) ANSI grade entry/egress/door ajar tracking mortise.
- B. Intercom System:
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide "LEM-1 DLS System" by Aiphone Corporation.
        - (a) No Substitutions
    - b. Complete intercom system including, but not limited to, master unit, door station, power supply and substations, if applicable.
      - 1) Master Unit LEM-1
      - 2) Door Station Transmitter L-ED
      - 3) Power Supply PT120NS
- C. Butt Hinges: Unless otherwise scheduled, shall be five-knuckle, full mortise template, ball bearing type with non-rising loose pin, flat button tip. Exterior hinges, and certain others as scheduled, shall have non-removable pins by use of set screw in the barrel. These are identified in the schedule as "NRP".
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Butt Hinges listed in hardware sets by McKinney Products Company, An ASSA ABLOY Group Company, or comparable product by one of the following:
        - (a) Hager Companies
        - (b) Stanley Commercial Hardware
    - b. Sizes:
      - 1) Size of hinges to be 3-1/2" x 3-1/2" for 1-3/8" doors
      - 2) Size of hinges to be 4-1/2" x 4-1/2" for 1-3/4" doors up to 36" wide; 37" to 48 hinges to be 5" x 4-1/2" unless listed otherwise in hardware sets.
- D. Standard Locks and Latches: Locks shall utilize standard cutouts to facilitate interchange without further mortising. Strikes for locks and latches shall have only the minimum lip projection required to protect trim. Lock and trim shall conform to ANSI/BHMA A156.2. Levers shall match Electronic Lock Levers.
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Butt Standard Locks and Latches listed in hardware sets by Sargent Manufacturing Co., An ASSA ABLOY Group Company, or comparable product by one of the following:
        - (a) PDQ Manufacturing
        - (b) Hager Companies
        - (c) Schlage, an Allegion Brand
        - (d) Yale Commercial Locks & Hardware, An ASSA ABLOY Group Company
        - (e) Stanley Commercial Hardware
- E. Exit Devices for Exterior Doors and High-Frequency Doors: Shall be listed under "Panic Hardware" in accident equipment lists of Underwriters Laboratories. Where labeled fire doors are used as exits, they shall be equipped with labeled "Fire Exit Hardware". Exit devices shall conform to ANSI/BHMA A156.3
1. Products:
    - a. Preferred Manufacturers:
      - 1) None

- 2) Basis-of-Design Product: Subject to compliance with requirements, provide Exit Devices listed in hardware sets by Von Duprin, an Allegion Brand, or comparable product by one of the following:
    - (a) Precision Hardware, Stanley Security Solutions, Inc
    - (b) Sargent Manufacturing Co., An ASSA ABLOY Group Company
    - (c) Yale Commercial Locks & Hardware, An ASSA ABLOY Group Company
  - 3) All exit devices with Electric Latch Retraction feature shall be fail secure unless noted otherwise.
- F. Exit Devices for Interior Doors and Standard-Frequency Doors: Shall be listed under "Panic Hardware" in accident equipment lists of Underwriters Laboratories. Where labeled fire doors are used as exits, they shall be equipped with labeled "Fire Exit Hardware". Exit devices shall conform to ANSI/BHMA A156.3
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Exit Devices listed in hardware sets by Von Duprin, an Allegion Brand, or comparable product by one of the following:
        - (a) Precision Hardware, Stanley Security Solutions, Inc
        - (b) Sargent Manufacturing Co., An ASSA ABLOY Group Company
        - (c) Yale Commercial Locks & Hardware, An ASSA ABLOY Group Company
- G. Push/Pulls
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Push/Pulls listed in hardware sets by Trimco/BBW, or comparable product by one of the following:
        - (a) Ives, an Allegion Brand
        - (b) Rockwood Manufacturing Co., An ASSA ABLOY Group Company
        - (c) Hager Companies
- H. Electric Strikes
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Electric Strikes listed in hardware sets by Folger Adam EDC, An ASSA ABLOY Group Company, or comparable product by one of the following:
        - (a) HES, An ASSA ABLOY Group Company
        - (b) Von Duprin, an Allegion Brand
      - 3) All electric strikes shall be fail secure unless noted otherwise.
- I. Electromagnetic Hold-Open
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Electromagnetic Hold-Opens listed in hardware sets by Rixson Specialty Door Controls An ASSA ABLOY Group Company, or comparable product by one of the following:
        - (a) Architectural Builders Hardware Mfg., Inc.
        - (b) LCN Closers, an Allegion Brand
        - (c) Sargent Manufacturing Co., An ASSA ABLOY Group Company
        - (d) Hager Companies

- J. Electric Power Transfer Devices
1. Electric power transfer devices shall be used that may contain one of the following combinations of conductors:
    - a. Ten (10) or more conductors minimum 24AWG
    - b. Two (2) conductors 18AWG and four (4) conductors minimum 24AWG
    - c. Power transfer device shall be concealed
    - d. The power transfer device shall be separate from the door hinges and shall not support any of the door weight.
- K. Door Closers (Except for Concealed): Except where other device for automatically closing and controlling the action of swing doors is noted, shall be hydraulic type of rack and pinion design with working parts enclosed in a cast iron or aluminum case. For doors subject to positive or negative HVAC pressures, closer size shall be adjusted accordingly. All Closers shall NOT be fastened with Through Bolts through doors. All Wood Doors with closers to be provided with 5" wood top block.
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Door Closers listed in hardware sets by Yale Commercial Locks & Hardware, An ASSA ABLOY Group Company, or comparable product by one of the following:
        - (a) LCN Closers, an Allegion Brand
        - (b) Sargent Manufacturing Co., An ASSA ABLOY Group Company
        - (c) Hager Companies
        - (d) DORMA Americas
        - (e) Norton Door Controls, An ASSA ABLOY Group Company
        - (f) Stanley Commercial Hardware
    - b. Materials and Features:
      - 1) ANSI/BHMA A156.4, Grade 1
      - 2) ICC/ANSI A117.1-2003
      - 3) UL listed. Provide closers for fire rated openings in compliance with NFPA 80, NFPA 101, and local building codes.
      - 4) Provide closers with full molded plastic covers
      - 5) Extreme temperature fluid (temperature range from -30 degrees F to 120 degrees F.)
      - 6) Provide delayed action closers where required by code
      - 7) Provide sex nuts and bolts (SNB) or thru bolts (TB) on all labeled mineral core doors.
      - 8) Finish: Provide factory painted or powder finish on exposed metal to match hardware, unless indicated otherwise.
      - 9) Mounting: Hinge face mounting, unless otherwise indicated. Do not mount closers on exterior of building. Do not mount closers on Corridor side of doors.
      - 10) Size and mount units indicated or, if not indicated, to comply with manufacturer's recommendations for exposure conditions. Reinforce substrate as recommended.
      - 11) Closers to be installed to allow direction of door swing as shown on Drawings and as required to meet field conditions.
      - 12) Door pull force:
        - (a) Exterior Doors: Maximum 8.5 lbs.
        - (b) Interior Doors: Maximum 5.0 lbs.
      - 13) Provide mounting or drop plates as required by job conditions.
- L. Door Closers (Concealed): Rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and

anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Products:

a. Preferred Manufacturers:

- 1) None
- 2) Basis-of-Design Product: Subject to compliance with requirements, provide Concealed Door Closers listed in hardware sets by Rixson Specialty Door Controls An ASSA ABLOY Group Company, or comparable product by one of the following:
  - (a) LCN Closers, an Allegion Brand
  - (b) Sargent Manufacturing Co., An ASSA ABLOY Group Company
  - (c) Yale Commercial Locks & Hardware, An ASSA ABLOY Group Company

b. Materials and Features:

- 1) ANSI/BHMA A156.4, Grade 1
- 2) ICC/ANSI A117.1-2003
- 3) UL listed. Provide closers for fire rated openings in compliance with NFPA 80, NFPA 101, and local building codes.
- 4) Extreme temperature fluid (temperature range from -30 degrees F to 120 degrees F.)
- 5) Provide delayed action closers where required by code
- 6) Concealed Overhead Closer: Mortised into head frame; with cast-metal body and exposed cover plate.
- 7) Size and mount units indicated or, if not indicated, to comply with manufacturer's recommendations for exposure conditions. Reinforce substrate as recommended.
- 8) Closers to be installed to allow direction of door swing as shown on Drawings and as required to meet field conditions.
- 9) Door pull force:
  - (a) Exterior Doors: Maximum 8.5 lbs.
  - (b) Interior Doors: Maximum 5.0 lbs.

M. Door Stops: Wall type door bumpers shall be in accordance with ANSI/BHMA A156.16 and be provided for all openings where conditions permit. In the event a wall type bumper cannot be used, a floor stop shall be provided.

1. Products:

a. Preferred Manufacturers:

- 1) None
- 2) Basis-of-Design Product: Subject to compliance with requirements, provide Wall or Floor Stops listed in hardware sets by Trimco/BBW, or comparable product by one of the following:
  - (a) Ives, an Allegion Brand
  - (b) Rockwood Manufacturing Co., An ASSA ABLOY Group Company
  - (c) Hager Companies

b. Door Stop Mounting: Methods to suit substrates encountered (plastic anchor, drywall anchor, expansion shield, etc.)

c. Provide gray rubber exposed resilient parts

d. Do not furnish aluminum floor stops

e. Adjust height of floor stops to suit undercut of adjacent door.

N. Manual Flush Bolts:

1. Manual Flush Bolts: ANSI/BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
2. Manual-Extension Flush Bolts: Grade 1, fabricated from extruded brass or aluminum, with 12-inch rod actuated by flat lever; listed and labeled for fire-rated doors, where required. Provide with dustproof strike.



3. Slide Flush Bolts: Grade 1, cast brass, with rod actuated by slide. Provide with dustproof strike.
  4. Dustproof Strikes: Grade 1, polished wrought brass, with 3/4-inch- diameter, spring-tension plunger.
- O. Automatic And Self-Latching Flush Bolts:
1. Automatic Flush Bolts: Grade 1, fabricated from steel and brass components, with spring-activated bolts that automatically retract when active leaf is opened and that automatically engage when active door depresses bolt trigger; listed and labeled for fire-rated doors where required. Provide brass or stainless-steel cover plate, top and bottom dustproof strikes, guides, guide supports, wear plates, and shims.
  2. Self-Latching Flush Bolts: Grade 1, fabricated from steel and brass components, with spring-activated bolts that automatically engage when active door depresses trigger; listed and labeled for fire-rated doors where required. Bolts are manually retracted by a slide in the bolt face. Provide brass or stainless-steel cover plate, dustproof top and bottom strikes, guides, guide supports, wear plates, and shims.
  3. Dustproof Strikes: Grade 1, polished wrought brass, with 3/4-inch- diameter, spring-tension plunger.
- P. Door Viewers:
1. 190 degree angle of view. Provide rotating metal cover to match viewer at guestrooms.
  2. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Door Viewers listed in hardware sets by Rockwood Manufacturing Co., An ASSA ABLOY Group Company, or comparable product by one of the following:
        - (a) "Model DT101589"; Tell Manufacturing, Inc.
        - (b) No Substitutions
- Q. Thresholds:
1. Thresholds at all doors usable by the handicapped shall not exceed 1/2" in height above finished floor with a maximum slope of 1:2 in accordance with ADA, and shall be in accordance with ANSI/BHMA 156.21.
  2. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Door Thresholds listed in hardware sets by Pemko Manufacturing Company, or comparable product by one of the following:
        - (a) National Guard Products, Inc. (NGP)
        - (b) Hager Companies
- R. Weatherstrip, Sound Seals, Door Sweeps and Astragals.
1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide weatherstrip, sound seals, door sweeps and astragals listed in hardware sets by Pemko Manufacturing Company, or comparable product by one of the following:
        - (a) National Guard Products, Inc. (NGP)
- S. Door Guards: Provide all guest room entry door guards.
1. Products:
    - a. Preferred Manufacturers:
      - 1) None

- 2) Basis-of-Design Product: Subject to compliance with requirements, provide Door Guards listed in hardware sets by Rockwood Manufacturing Co., An ASSA ABLOY Group Company, or comparable product by one of the following:
  - (a) Pemko Manufacturing Company
- T. Protective Plates and Trim: Materials: Protection plates conforming to ANSI/BHMA 156.6, .050 minimum thickness, beveled edges (B4E) four sides. Mount centered, flush with bottom of door. Screws: Phillips head sheet metal screws plated to match plate.
  1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Protective Plates and Trim listed in hardware sets by Trimco/BBW, or comparable product by one of the following:
        - (a) Ives, an Allegion Brand
        - (b) Rockwood Manufacturing Co., An ASSA ABLOY Group Company
        - (c) Hager Companies
  - U. Silencers for Metal Door Frames: ANSI/BHMA 156.16 Grade 1; neoprene or rubber, minimum diameter 1/2-inch; fabricated for drilled application to frame.
  - V. Key Control Box:
    1. Products:
      - a. Preferred Manufacturers:
        - 1) None
        - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Model "Regent RWC Series" by Telkee, Inc.
          - (a) No Substitutions
      - b. Wall mounted lockable key cabinet complying with ANSI/BHMA A156.5.
      - c. Size: Sized for actual quantities of keys, plus 25%, plus additional capacity for 12 housekeeper pouches.
      - d. One wall mounted lockable key cabinet for four (4) key rings.
      - e. One key control log book.
      - f. Provide two (2) sets of color coded and numbered tags for key ring identification.

## 2.04 CYLINDERS AND KEYING

- A. Hotel System-Permanent Keying:
  1. Products:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Basis-of-Design Product: Subject to compliance with requirements, provide Cylinder Model "VA" by Sargent Manufacturing Co., An ASSA ABLOY Group Company, or comparable product by one of the following:
        - (a) "1345"; Schlage Electronics, an Allegion Brand
    - b. All locksets shall have manufacturer's restricted keyway, reserved for Owner's use only.
    - c. All locksets shall be construction masterkeyed.
    - d. Owner will provide keying requirements for hotel system.
    - e. Locksets and cylinders shall contain 6-pin tumblers.
    - f. Furnish the following quantities of keys:
 

1) Grandmaster Keys (GMK)	10 each
2) Master Keys (each MK set)	5 each
3) Change Keys per lock	3 each
4) Keyed alike sets (each set)	4 each
5) Removable core control keys	4 each
    - g. Hotel System-Master Keying: Coordinate with Owner based upon the following general requirements.

- 1) Administrative Master Key "AA" - Operates all locks in the administrative and office areas of the hotel.
  - 2) Engineering Master Key "AB" - Operates all locks in the engineering and maintenance areas, (i.e., engineer's office, entire maintenance section, mechanical and electrical rooms, utility closets, janitors closets, and all exterior doors, including the roof).
  - 3) Food and Beverage Master Key "AC" - Operates all locks under the direct supervision of the steward, (i.e. kitchen, banquet rooms, food storage rooms, dining rooms and kitchen offices).
  - 4) Housekeeping Master Key "AD" - Operates all locks under the direct supervision of the housekeeper, (i.e., housekeeper's office, pantries, linen rooms and linen chutes on guest floors and laundry room area).
  - 5) Health and Exercise Master Key "AE" - Operates all locks in the health/exercise areas, (i.e., swimming pool, exercise room, pool lockers and game room).
  - 6) Grand Master Key "A" - Operates locks as noted in paragraphs a through e above. Upon authorization of the Owner, keyblanks shall be sold only by direct main from the door lock manufacturer.
  - 7) Keyed alike in sets, each set different.
    - (a) Electrical and telephone closets.
    - (b) Two or more doors to or from the same room area or space.
    - (c) Public meeting room doors in accordance to areas subdivided by operable partitions.
    - (d) Linen rooms and chute area doors.
- B. Hotel System - Temporary Construction Keying:
1. Furnish temporary construction keying for use during construction. Prior to Owner occupancy of the building, the General Contractor with the Owner's Representative shall void out the construction keys.
  2. Furnish 25 Construction Master Keys.

## **2.05 MISCELLANEOUS REQUIREMENTS**

- A. The hardware shall be the proper kind for its required use and shall fit its intended location. Should any hardware, as specified, fail to meet the intended requirements or require modification to suit the intended location, this matter, or any other necessary advance information, shall be brought to the attention of the [Architect] [Owner's Representative] for correction or decision in ample time to avoid delay in the manufacture and delivery of hardware.
- B. The finish hardware listed herein shall not be construed as necessarily being a complete hardware schedule, but shall be considered as an indication of the hardware requirements desired by the Architect. It shall be the Contractor's responsibility to examine the Drawings and door schedules and provide all necessary or additional hardware as required but not scheduled herein. Such items of hardware shall be of the same type, quality, and quantity as that scheduled for similar doors or similar purposes.
- C. In the accompanying hardware list, catalog numbers used are those of specific manufacturers, used to establish a minimum standard of quality and requirements as to type, weight, mechanical construction and operation to which hardware shall conform. That list indicates manufacturers on which catalog numbers are based, as well as acceptable equivalent manufacturers.
- D. Finish:
  1. All hardware items not otherwise scheduled shall have the following finish:
    - a. Refer to Hardware Sets in Hardware Schedule
    - b. Finish and Base Material Designations: Numbers indicate ANSI/BHMA A156.18 Finish Standards, or nearest traditional U.S. Commercial Finish Standards, or manufacturer's finish designation.

## EXECUTION

### 3.01 INSPECTION

- A. Verify that doors and frames are ready to receive work and dimensions, are as indicated on Shop Drawings, and as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

### 3.02 INSTALLATION

- A. Install each hardware item in compliance with manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finished, reinstall each item. Do not install surface-mounted items until finishes have been completed on the substrate.
- B. Conform to [2010 ADA Standards] [\[HYPERLINK TEXT\] ICC A117.1-2009](#) [governing code] for positioning requirements for the Disabled.
  - 1. Opening Force: The maximum force for pushing pulling open doors shall be [5] pounds in accordance with [2010 ADA Standards] [\[ANSI ICC A117.1-2009\]](#) [insert governing code].
- C. All door closers shall be installed out of public sight wherever possible.

### 3.03 FASTENINGS

- A. Suitable size, quantity, and material with finish to match the hardware.
- B. Machine screws for attaching hardware to metal.
- C. Self-tapping screws for attaching kickplate to hollow metal or wood mineral core doors.
- D. Full thread type screws for attaching butt hinges to wood or mineral core doors.
- E. Sex bolts and sleeves for attaching surface closers or arm to mineral core doors.
- F. Non-ferrous or corrosion resistant steel fasteners for items exposed to weather.

### 3.04 HARDWARE LOCATIONS

- A. Hardware mounting heights shall conform to the following unless otherwise indicated on the drawings.
  - 1. Hinges:
    - Top - 5" from head to top of hinge leaf.
    - Bottom - 10" from bottom of hinge to finished floor.
    - Intermediates.
    - Intermediates - Equal distance between top and bottom hinges (Maximum 3'-0")
  - 2. Card Readers: 40" from finish floor to centerline
  - 3. Locks/Latches: 38" from finish floor to center of lock/latch.
  - 4. Deadlocks/Deadbolts: 48" from finished floor to center of cylinder.
  - 5. Door Guards: 60" from finished floor to center line.  
At Accessible Guest Rooms maximum 48" from finished floor to center line.
  - 6. Door Viewer: 57" from finished floor to center line.  
At Accessible Guest Rooms, provide two door viewers with mounting heights at 45" and 57" from finish floor to centerline.
  - 7. Doorpulls, Pushplates Pushbars: 45" from finish floor to centerline.
  - 8. Exit Device Crossbars: 38" from finish floor to center of crossbar.
  - 9. Electromagnetic Hold-Open: Set wall mounted type 72" from finish floor to centerline.  
Wall mounted templates shall be issued by hardware supplier.

### 3.05 HARDWARE INSTALLATION

- A. Coordination:
  - 1. Fit and adjust hardware in accordance with manufacturer's packaged instructions.
  - 2. Coordinate installation with all trades, millwork, finish hardware, door frames and electrical.
- B. Sound and Smoke Seals:
  - 1. Install adhesive seals per manufacturer's instructions. Pre-cut pieces to fit before installing. Do not install as one continuous piece. Install jamb pieces first and header piece last. Position jamb pieces on the door frame rabbet 1/16" from the header rabbet to allow for header piece clearance. Install header piece on the header rabbet with ends overlapping and fitting above jamb piece.
  - 2. Install adhesive seals on astragal of double doors.
- C. Door Viewers: 150 degree viewers at Guest Room doors. 190 degree extra wide angle view at ballroom and meeting room doors.
- D. Door Guards: Guest Room entry door guards shall have strike plate furnished standard with door guard.

### 3.06 ADJUSTING

- A. Adjustments:
  - 1. Weatherstripping and sound/smoke seals shall not interfere with operation of doors and shall be adjusted accordingly.
  - 2. Secure door bottom in strict accordance with manufacturer's printed instructions and as required to seal door to threshold.
  - 3. Door seals to provide intended functions. Replace seals which do not perform.
  - 4. Adjust door so that lockset can be easily opened with a key/card key without binding between the latchbolt and strike. Doors too tight (or too loose) will not be accepted.
  - 5. Clearances between door and frame, at jambs and head: No greater than 1/8" +/- 1/16".
  - 6. Prior to Owner's "soft opening" replace Guest Room battery power supply units with new alkaline batteries.

### 3.07 PROTECTION

- A. Reinstall wrappings furnished by manufacturer for protecting items such as levers, handles and pulls.
- B. Do not remove manufacturer's protective covering of flat items such as kickplates and push plates until just prior to final acceptance of the building.

### 3.08 CLEANING

- A. After installation, clean metal surfaces on both interior and exterior of all mortar, plaster, paint and other contaminants. After cleaning, protect work against damage.

### 3.09 FINAL ADJUSTMENT

- A. Whenever hardware is installed more than one month prior to acceptance or occupancy of a space or area, return during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area.
- B. At the completion of the project, manufacturers' suppliers or representatives shall inspect their hardware and make any corrections required due to errors or improper installation.

### 3.10 HARDWARE SCHEDULE

#### 3.11 HW SET - T1B GUEST ENTRY

- A. SINGLE DOORS 01
- B. EACH DOOR TO HAVE:
- C. HINGES      TA2714 4.5 X 4.5      US26D      MCK
- D. LOCK      MT RFID X BLE X ADB X TROY      US26D      SAF
- E. CLOSER      2701      689      YAL

- F. DOOR GUARD 607 PDL US26D ROS
- G. DOOR VIEWER 627 (WITH HINGED COVER) US26D RO
- H. WALL STOP 1270WVCP US26D TRM
- I. DOOR SEALS S773D PEM
- J. AUTO DOOR 411APKL (ROUTED INTO BOTTOM
- K. BOTTOM OF DOOR) PEM
- L. MAG SWITCH REFER TO SECTION 25 51 10

### 3.12 HW SET - T1C ACCESSIBLE GUEST ENTRY

- A. SINGLE DOORS 01A
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X ADB X BLE X TROY US26D SAF
- E. CLOSER 2701 689 YAL
- F. DOOR GUARD 607 PDL US26D RO
- G. DOOR VIEWER 627 (WITH HINGED COVER) US26D RO
- H. WALL STOP 1270WVCP US26D TRM
- I. DOOR SEALS S773D PEM
- J. AUTO DOOR 411APKL (ROUTED INTO BOTTOM
- K. BOTTOM OF DOOR) PEM
- L. MAG SWITCH REFER TO SECTION 25 51 10

### 3.13 HW SET - T2C GUEST BATH

- A. SINGLE DOORS 02
- B. EACH DOOR TO HAVE:
- C. HINGES T2714 4.5 X 4.5 US26D MK
- D. PRIVACY SET 28-65U65-KL US26D SG
- E. TUB STOP 1275 US26D TRM
- F. SILENCERS 1229A TRM

### 3.14 HW SET - T2E ACCESSIBLE GUEST BATH

- A. SINGLE DOORS 03
- B. EACH DOOR TO HAVE:
- C. HINGES T2714 4.5 X 4.5 US26D MCK
- D. PRIVACY SET 28-65U65-KL US26D SAR
- E. OVERHEAD STOP 10-546 US26D RIX
- F. SILENCERS 1229A TRM

### 3.15 HW SET - T5 COMMUNICATING DOORS

- A. COMMUNICATING PAIR DOORS 04
- B. EACH DOOR TO HAVE:
- C. SPRING HINGES 1502 4.5 X 4.5 US26D MCK
- D. HINGE TA2714 4.5 X 4.5 US26D MCK
- E. or
- F. HINGES TA2714 4.5 X 4.5 US26D MCK

- |    |   |               |       |     |
|----|---|---------------|-------|-----|
| G. | COMM LOCKSET  | 28-65G15-3 KL | US26D | SAR |
| H. | DEADBOLT 489  | US26D         | SAR   |     |
| I. | WALL STOP 1270WVCP  | US26D         | TRM   |     |
| J. | OR  |               |       |     |
| K. | WALL STOP   |               |       |     |
| L. | AT MIRROR 1204 (SEE NOTE)   | US26D         | TRM   |     |
| M. | AUTO DOOR   |               |       |     |
| N. | BOTTOM 411  | US27          | PEM   |     |
| O. | DOOR SEALS S773D  |               | PEM   |     |
| P. | VERIFY SIZE OF DOOR STOP TO PREVENT LEVER FROM STRIKING WALL MIRROR |               |       |     |

### 3.16 HW SET - T10A INTERIOR STAIRS

- |    |   |       |     |  |
|----|---|-------|-----|--|
| A. | SINGLE DOORS 50                                 |       |     |  |
| B. | EACH DOOR TO HAVE:                              |       |     |  |
| C. | HINGES TA2714 4.5 X 4.5                         | US26D | MCK |  |
| D. | PASSAGE SET 28-10U15 LL                         | US26D | SAR |  |
| E. | CLOSER 2701 689                                 | YAL   |     |  |
| F. | FLOOR STOP 1231                                 | US26D | TRM |  |
| G. | WALL MAGNET FM998                               | US28  | RIX |  |
| H. | DOOR SEALS S773D                                | PEM   |     |  |
| I. | WALL MAGNETS TO BE TIED INTO FIRE ALARM SYSTEM. |       |     |  |

### 3.17 HW SET - T11A EXTERIOR STAIRS

- |    |                             |       |     |  |
|----|-----------------------------|-------|-----|--|
| A. | SINGLE DOORS 51             |       |     |  |
| B. | EACH DOOR TO HAVE:          |       |     |  |
| C. | HINGES TA2314 4.5 X 4.5 NRP | US26D | MCK |  |
| D. | EXIT DEVICE 99E0            | US26D | VDI |  |
| E. | CLOSER 2721 689             | YAL   |     |  |
| F. | THRESHOLD 172A              | US27  | PEM |  |
| G. | DOOR SWEEP 315CN            | US28  | PEM |  |
| H. | DOOR SEALS S773D            | PEM   |     |  |

### 3.18 HW SET - T12B EXTERIOR CORRIDOR / EXTERIOR BUFFET / POOL TO CO

- |    |                         |       |     |  |
|----|-------------------------|-------|-----|--|
| A. | SINGLE DOORS 60, 63, 68 |       |     |  |
| B. | EACH DOOR TO HAVE:      |       |     |  |
| C. | OH CONCEALED            |       |     |  |
| D. | CLOSER 0608090N X LCP   | US26D | RIX |  |
| E. | ELEC. EXIT              |       |     |  |
| F. | DEVICE EL33NL-OP        | US26D | VDI |  |
| G. | CYLINDER 34             | US26D | SAR |  |
| H. | FLOOR STOP 1233         | US26D | TRM |  |
| I. | ELEC POWER              |       |     |  |
| J. | TRANSFER EPT10          | VDI   |     |  |
| K. | POWER SUPPLY PS914      |       | VDI |  |

- L. RFID REMOTE
- M. READER RCU RFID X BLE US32D SAF
- N. INTERCOM AS LISTED BELOW TO BE USED AT EXTERIOR DOOR 63 ONLY.
- O. AIPHONE INTERCOM
- P. SYSTEM LEM-1 DLS AIP
- Q. CONTINUOUS HINGES, PULLS, THRESHOLD, AND DOOR SEALS FURNISHED BY DOOR SUPPLIER.

### 3.19 HW SET - T13 EXTERIOR MEETING ROOM (OPTIONAL 4-BAY ONLY)

- A. SINGLE DOOR 69
- B. EACH DOOR TO HAVE:
- C. HINGES TA2314 4.5 X 4.5 NRP US26D MCK
- D. OH CONCEALED
- E. CLOSER 0608090N X LCP US26D RIX
- F. EXIT DEVICE CD33EO US26D VDI
- G. CYLINDER 42 US26D SAR
- H. THRESHOLD 172A US27 PEM
- I. DOOR SWEEP 315AN US27 PEM
- J. DOOR SEALS S773D PEM
- K. FLOOR STOP 1233 US26D TRM
- L. NOTE: COORDINATE WITH VISION CONTROL GLASS PER SECTION 08 80 00.

### 3.20 HW SET - T15 EXTERIOR REAR ENTRY

- A. SINGLE DOORS 11
- B. EACH DOOR TO HAVE:
- C. OH CONCEALED
- D. CLOSER 0608090N X LCP US26D RIX
- E. FLOOR STOP 1233 US26D TRM
- F. CONTINUOUS HINGES, PUSH/PULLS, THRESHOLD, AND DOOR SEALS FURNISHED BY DOOR SUPPLIER.

### 3.21 HW SET-T15B EXTERIOR ENTRY VESTIBULE (AUTOMATIC SLIDING DOORS)

- A. PAIR DOORS 61
- B. EACH PAIR TO HAVE:
  - 1. NOTE: AUTOMATIC DOOR HARDWARE & ACCESSORIES BY DOOR MANUFACTURER

### 3.22 HW SET - T15C INTERIOR ENTRY VESTIBULE (AUTOMATIC SLIDING DOORS)

- A. PAIR OF DOORS 26
- B. EACH PAIR TO HAVE:
  - 1. PUSH BUTTON
  - 2. RELEASE MUSHROOM BUTTON 32310 SAF
  - 3. KEYSWITCH 653-04 US26D SCE
  - 4. CYLINDER 41 (@ KEYSWITCH) US26D SAR
  - 5. RFID REMOTE
  - 6. CONTROL UNIT FLUSH MTD. 94770 RFID SAF
  - 7. POWER SUPPLY 32280 US26D SAF
  - 8. AIPHONE INTERCOM
  - 9. SYSTEM LEM-1 DLS AIP



C. AUTOMATIC DOOR HARDWARE & ACCESSORIES BY DOOR MANUFACTURER

**3.23 HW SET - T16A MEETING ROOM STORAGE**

- A. PAIR DOORS 34
- B. EACH PAIR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. FLUSH BOLTS 3917 US26D TRM
- E. DUST PROOF
- F. STRIKE 3910 US26D TRM
- G. LOCK MT RFID X BLE X (LESS DEADBOLT)
- H. X TROY US26D SAF
- I. CLOSER 2701 (ACTIVE LEAF) 689 YAL
- J. WALL STOPS 1270WVCP US26D TRM
- K. ASTRAGAL S772 PEM
- L. DOOR SEALS S773D PEM

**3.24 HW SET - T16B MATV / MECH / ELEC / TEL / WATER / STORAGE / IT CLOSET / COMPUTER**

- A. SINGLE DOORS 12, 17, 29, 31, 32, 35, 42, 43, 44, 45
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE X (LESS DEADBOLT)
- E. X TROY US26D SAF
- F. CLOSER 2701 689 YAL
- G. DOOR SEALS S773D PEM
- H. WALL STOP 1270WVCP US26D TRM
- I. SILENCERS 1229A TRM
- J. HANDICAP WARNING ONLY ON MECHANICAL/ELECTRICAL ROOMS.

**3.25 HW SET - T17A LINEN / LINEN CHUTE / HOUSEKEEPING / ENGINEER**

- A. SINGLE DOORS, 40
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE X (LESS DEADBOLT)
- E. X TROY US26D SAF
- F. CLOSER 2701 689 YAL
- G. STOP 1270WVCP/1231 US26D TRM
- H. DOOR SEALS S773D PEM

**3.26 HW SET - T18 ELEVATOR EQUIPMENT**

- A. SINGLE DOORS 20
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE X (LESS DEADBOLT)
- E. X TROY US26D SAF
- F. CLOSER 2701 689 YAL

- G. WALL STOP 1270WVCP US26D TRM
- H. DOOR SEALS S773D PEM

### 3.27 HW SET - T20 MEETING ROOM (OPTIONAL 4-BAY ONLY)

- A. PAIR DOORS 33
- B. EACH PAIR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US15 MCK
- D. EXIT DEVICES 9927L-F-EO US26D VDI
- E. EXIT DEVICES 9927L-F US26D VDI
- F. EXIT TRIM MT RFID X BLE X TROY US26D SAF
- G. CLOSER 2701 689 YAL
- H. VIEWER 628 US26D RO
- I. FLOOR STOPS 1231 US32D TRM
- J. WALL MAGNET FM998 US32D RIX
- K. DOOR SEALS S773D PEM
- L. WALL MAGNET TO BE TIED INTO FIRE ALARM SYSTEM.
- M. DOOR VIEWER TO VIEW IN TO ROOM FROM CORRIDOR

### 3.28 HW SET - T20B MEETING

- A. SINGLE DOORS 30
- B. EACH DOOR TO HAVE:
- C. LOCKSET MT RFID X ADB X BLE X TROY US26D SAF
- D. CLOSER 2701 689 YAL
- E. VIEWER 628 US26D RO
- F. WALL STOP 1270WVCP US26D TRM
- G. WALL MAGNET FM998 US32D RIX
- H. DOOR VIEWER TO VIEW IN TO ROOM FROM CORRIDOR
- I. WALL MAGNET TO BE TIED INTO FIRE ALARM SYSTEM.
- J. CONTINUOUS HINGES & DOOR SEALS FURNISHED BY DOOR SUPPLIER.

### 3.29 HW SET - T21B EXTERIOR POOL STORAGE / POOL MECH

- A. SINGLE DOORS 64, 66
- B. EACH DOOR TO HAVE:
- C. HINGES TA2314 4.5 X 4.5 NRP US26D MCK
- D. LOCKSET 76-8204 LNL US26D SAR
- E. CLOSER 2721 689 YAL
- F. THRESHOLD 172A US27 PEM
- G. DOOR SWEEP 315CN US28 PEM
- H. DOOR SEALS S773D PEM

### 3.30 HW SET - T23A MEN/WOMEN RESTROOMS

- A. SINGLE DOORS 16
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. PUSH/PULL 1001-3 / 1013-3B US26 TRM

- E. DEADBOLT 484 US26 SAR
- F. PRIVACY SET 28-10U65 LL US26D SAR
- G. CLOSER 2701 689 YAL
- H. WALL STOP 1204 US26D TRM
- I. DOOR SEALS S773D PEM

### 3.31 HW SET - T24A EXERCISE / INTERIOR POOL

- A. SINGLE DOORS 14
- B. EACH DOOR TO HAVE:
- C. OH CONCEALED
- D. CLOSER 0608090N X LCP US26D RIX
- E. ELECTRO. LOCK 390 X ATD X MBS US26D SCE
- F. DOOR SENSOR SCAN II US26D PUL
- G. POWER SUPPLY PS902 VDI
- H. RFID REMOTE
- I. READER RCU RFID X BLE US32D SAF
- J. PUSH BUTTON 701 RD EX SCE
- K. CONTINUOUS HINGES, PUSH/PULLS, THRESHOLD & DOOR SEALS FURNISHED BY DOOR SUPPLIER.

### 3.32 HW SET - T25B GUEST LAUNDRY

- A. SINGLE DOORS 15
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE (LESS DEADBOLT)
- E. X TROY US26D SAF
- F. CLOSER 2701 689 YAL
- G. WALL STOP 1270WCVP US26D TRM
- H. DOOR SEALS S773D PEM

### 3.33 HW SET - T26B WORK ROOM

- A. SINGLE DOORS 25
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE (LESS DEADBOLT)
- E. X TROY US26D SAF
- F. CLOSER 2721 689 YAL
- G. DOOR SEALS S773D PEM
- H. SILENCERS 1229A TRM

### 3.34 HW SET - T26C LAUNDRY FROM WORK ROOM

- A. SINGLE DOORS 22
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE (LESS DEADBOLT)
- E. X TROY US26D SAF

- F. CLOSER 2701 689 YAL
- G. AUTO DOOR
- H. BOTTOM 4131CPKL US28 PEM
- I. DOOR SEALS S773D PEM

### 3.35 HW SET - T27B LAUNDRY FROM CORRIDOR

- A. PAIR DOORS 19
- B. EACH PAIR TO HAVE:
- C. HINGES T4A3786 4.5 X 4.5 US26D MCK
- D. FLUSH BOLTS 3917 US26D TRM
- E. DUST PROOF
- F. STRIKE 3910 US26D TRM
- G. LOCK MT RFID X BLE (LESS DEADBOLT)
- H. X TROY US26D SAF
- I. CLOSER 2701 (ACTIVE LEAF) 689 YAL
- J. KICKPLATE K0050 8" x 2" LDW (ACT LEAF) US26D TRM
- K. WALL STOP 1270WVCP (ACTIVE LEAF) US26D TRM
- L. DOOR SEALS S773D PEM

### 3.36 HW SET - T28A EMPLOYEE BREAKROOM

- A. SINGLE DOORS 18
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE (LESS DEADBOLT)
- E. X TROY US26D SAF
- F. CLOSER 2701 689 YAL
- G. WALL STOP 1270WVCP US26D TRM
- H. SILENCERS 1229A TRM

### 3.37 HW SET - T28B POOL VESTIBULE

- A. SINGLE DOORS 13
- B. EACH DOOR TO HAVE:
- C. CLOSER 2701 689 YAL
- D. WALL STOP 1270WVCP US26D TRM
- E. SILENCERS 1229A TRM
- F. CONTINUOUS HINGES, PUSH/PULLS, & DOOR SEALS FURNISHED BY DOOR SUPPLIER.

### 3.38 HW SET - T30A OFFICE

- A. SINGLE DOORS 24
- B. EACH DOOR TO HAVE:
- C. HINGES TA2714 4.5 X 4.5 US26D MCK
- D. LOCK MT RFID X BLE (LESS DEADBOLT)
- E. X TROY US26D SAF
- F. DOOR SEALS S773D PEM
- G. WALL STOP 1270WVCP US26D TRM

H. SILENCERS 1229A TRM

**3.39 HW SET - T31A FOOD PREP**

A. SINGLE DOORS 27, 36

B. EACH DOOR TO HAVE:

C. HINGES TA2714 4.5 X 4.5 US26D MCK

D. LOCK MT RFID X BLE (LESS DEADBOLT)

E. X TROY US26D SAF

F. CLOSER 2701 689 YAL

G. FLOOR STOP 1231 US26D TRM

H. SILENCERS 1229A TRM

**3.40 HW SET - T33 CROSS CORRIDOR**

A. PAIR DOORS 37

B. EACH PAIR TO HAVE:

C. HINGES T4A3786 4.5 X 4.5 US26D MCK

D. EXIT DEVICE 99L-F-BE US26D VDI

E. CLOSER 2701 689 YAL

F. WALL STOP 1270WVCP US26D TRM

G. WALL MAGNET FM998 689 RIX

H. DOOR SEALS S773D PEM

I. WALL MAGNET TO BE TIED INTO FIRE ALARM SYSTEM.

**3.41 HW SET - T35A DRYERS**

A. SINGLE DOORS 38

B. EACH DOOR TO HAVE:

C. HINGES TA2714 4.5 X 4.5 US26D MCK

D. PASSAGE SET 28-10U15 LL US26D SAR

E. WALL STOP 1270WVCP US26D TRM

F. SILENCERS 1229A TRM

**3.42 HW SET - T39A POOL GATE**

A. SINGLE GATES 70, 71

B. EACH GATE TO HAVE:

C. EXIT DEVICE MT RFID X BLE (LESS DEAD BOLT)

D. X TROY X F18-R US32D SAF/MN

**END OF SECTION**

## SECTION 08 80 00

### GLAZING

#### GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Section includes glass and glazing for:
    - a. Float Glass
    - b. Tempered Glass
    - c. Insulated Units
    - d. Vision Control Glass with Manually Adjustable Cordless Louvers
    - e. Fire Protective Rated Safety Glass
    - f. Decorative Laminated Glass
    - g. Decorative Film Overlay
    - h. Mirrors (Unframed)
- B. Related Sections:
  - 1. Section 07 92 00 (07920) - Joint Sealants
  - 2. Section 08 11 13 (08110) - Steel Doors and Frames
  - 3. Section 08 14 00 (08200) - Wood Doors
  - 4. Section 08 41 13 (08410) - Aluminum-Framed Entrances and Storefronts
  - 5. Section 08 42 29 (08460) - Automatic Entrance Doors
  - 6. Section 08 51 13 (08520) - Aluminum Windows
  - 7. Section 08 53 00 (08560) - Plastic Windows

##### 1.02 REFERENCES

- A. American Architectural Manufacturers Association (AAMA) Publications:
  - 1. 800-92 "Voluntary Specifications and Test Methods for Sealants"
- B. American National Standards Institute (ANSI) Publications:
  - 1. ANSI/AAMA 101 "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors"
- C. ASTM International (ASTM) Publications:
  - 1. C920 "Standard Specification for Elastomeric Joint Sealants"
  - 2. C1036 "Standard Specification for Flat Glass"
  - 3. C1048 "Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass"
  - 4. C1172 "Standard Specification for Laminated Architectural Flat Glass"
  - 5. C1376 "Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass"
  - 6. E1300 "Standard Practice for Determining Load Resistance of Glass in Buildings"
  - 7. E2190 "Standard Specification for Insulating Glass Unit Performance and Evaluation"
- D. Consumer Product Safety Commission (CPSC) Publications:
  - 1. 16 CFR 1201 - "Safety Standard for Architectural Glazing Materials"
- E. Glass Association of North America (GANA)
  - 1. "GANA Glazing Manual"
  - 2. "FGMA Sealant Manual"
- F. Insulating Glass Manufacturers Alliance (IGMA) Publications:
  - 1. SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units"
- G. National Fenestration Rating Council (NFRC)
- H. National Glass Association (NGA)
  - 1. Glazier Certification Program
  - 2. Underwriter's Laboratories, Inc. (UL) Standards:
    - 3. 10C "Positive Pressure Fire Tests of Door Assemblies"

### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.
  - 2. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.
- C. Samples: Submit, for verification purposes, 12" square samples of each type of glass indicated except for clear single pane units, and 12" long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color. Sample requirement may be waived by Owner's Representative at their discretion.

### 1.04 SYSTEM DESCRIPTION

- A. Vision Control Glass: Control vision through insulated glass unit assemblies by means of rotating, cordless, interlocking, horizontal, extruded aluminum louvers with rotation controlled manually. Rotation of louvers results in reduction in or elimination of vision through glazed assemblies.

### 1.05 QUALITY ASSURANCE

- A. Glazing Standards: Comply with recommendations of the Glass Association of North America (GANA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
- B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- C. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
  - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- E. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

## 1.07 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

## 1.08 WARRANTY

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. All material shall be free from manufacturer defects and installation workmanship. Any material or workmanship judged to be defective shall be replaced at no cost to the Owner.
- C. Insulating glass units shall be jointly guaranteed for a period of ten (10) years by the manufacturer and installer against obstruction of vision between interior glass surfaces caused by failure of the hermetic seal. Units damaged during guarantee period shall be replaced at no cost to the Owner.
- D. Vision Control Glass in Exterior Locations: Furnish manufacturer's ten (10) year warranty providing coverage against material obstruction of glass units by dust or film formation due to failure of hermetic seal.

## PRODUCTS

### 2.01 ACCEPTABLE GLASS MANUFACTURERS

- A. All glass shall be new material, graded under ASTM 1036.
- B. All glass in related area shall be from one manufacturer.
- C. C.

### 2.02 GLASS MATERIALS

- A. Refer to Drawings for location of glass.
- B. Glass [I]: Clear Float Glass: ASTM C1036, Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), as manufactured by one of the following:
  - 1. Preferred Manufacturers:
    - a. None
    - b. Approved Manufacturers:
      - 1) PPG Industries (800-377-5267)
      - 2) Pilkington North America (800-221-0444)
      - 3) Old Castle Glass, a CRH Company (800-899-8455)
      - 4) Viracon, Inc. (800-533-2080)
      - 5) AGC Glass Company North America (800-251-0441)
      - 6) Guardian Industries (248-340-1800) (Basis of Design)
- C. Glass [II]: Tempered Glass: 1/4", Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3, clear, fully tempered safety glass.
  - 1. All tempered glass shall conform to ASTM C1048, and Federal Standard CPSC 16 CFR 1201. Tempered glass shall bear permanent monogram indicating tempered quality. Fabrication marks on tempered glass shall be located to be concealed in completed installation.
  - 2. Color: Clear to match aluminum windows glazing, Section 08520 (08 51 13).
  - 3. Approved Manufacturers:
    - a. PPG Industries (800-377-5267)
    - b. Pilkington North America (800-221-0444)
    - c. Old Castle Glass, a CRH Company (800-899-8455)
    - d. Viracon, Inc. (800-533-2080)
    - e. AGC Glass Company North America (800-251-0441)
    - f. Guardian Industries (248-340-1800) (Basis of Design)



- D. Glass [III]: Coated Low Emissivity Glass: 1/4", Condition C (other coated glass), Type I (transparent glass, flat), Class I (clear), Quality q3 (glazing select), with coating type and performance characteristics complying with requirements specified below:
1. Low E Coating: Side [2] [3] on insulated units.
  2. Preferred Manufacturers:
    - a. None
    - b. Approved Manufacturers:
      - 1) "SNX 51/23 Clear-Clear" Guardian Industries (248-340-1800) Basis of Design)
- E. Sealed Insulating Glass Units
1. Preferred Manufacturers:
    - a. None
    - b. Approved Manufacturers:
      - 1) Oldcastle Building Envelope (formally Vistawall) (866-653-2278)
      - 2) Viracon, Inc. (800-533-2080)
      - 3) AGC Glass Company North America (800-251-0441)
    - c. Provide preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E2190 for performance classification indicated as well as with other requirements specified for glass characteristics, air, space, sealing system, sealant, space material, and desiccants.
      - 1) Total Thickness: 1"
      - 2) Thickness of Each Pane: 1/4"
      - 3) Air Space Thickness: 1/2"
      - 4) Thermal Performance (Full Frame Performance): Minimum Winter U-Value: [0.42]
      - 5) Exterior Pane of Glass: Glass Type [I] [or] [II], tempered in locations shown on Drawings
      - 6) Interior Pane of Glass: Glass [I] [or] [III], tempered in locations shown on Drawings.
      - 7) Sealing System: Manufacturer's Standard Dual Seal.
        - (a) Desiccant: Manufacturer's Standard - Either Molecular Sieve or Silica Gel or Blend of Both.
        - (b) Spacer Material: Manufacturer's Standard Metal, with [Clear Anodized Finish] [Bronze Anodized Finish].

## 2.03 VISION CONTROL GLASS

- A. Preferred Manufacturers:
1. None
- B. Approved Manufacturers:
1. "Vision Control Mini"; Unicel Architectural (800-668-1580)
- C. Materials:
1. Glass
    - a. Exterior Pane of Glass: Glass Type [I] [or] [II], tempered.
    - b. Interior Pane of Glass: Glass [I] [or] [III], tempered.
    - c. Louvers, Frames, and Operators:
      - 1) Louvers: Hollow extruded aluminum, interlocking profile, 3/16 inch thick x 7/8 inch deep; Duracron K-20794 Metallic Gray finish.
      - 2) Manual Operators: Thumb wheel type.
      - 3) Glass Frame (Trim Kit): Extruded aluminum, factory glazed, sized to accept 1-3/4 inch thick glass for insertion into 1-3/4 inch thick doors; Duracron K-20794 Metallic Gray finish.

## 2.04 FIRE-PROTECTIVE GLAZING PRODUCTS

- A. Fire-Protective, Ceramic Glazing Material: Proprietary product in the form of two plies of laminated clear ceramic flat sheets, permanently labeled with appropriate marks of testing and inspecting agency, acceptable to authorities having jurisdiction, showing product complies with fire-protective installation indicated, and as follows:
1. Safety Glass: Shall conform to ASTM C1048, and Federal Standard CPSC 16 CFR 1201.
  2. Polished on both surfaces, transparent with minimum visible light transmission of 85 percent.
  3. Positive Pressure: Shall meet requirements of positive pressure test standards UL 10C.
  4. NFPA 252 for Door Assemblies.
  5. NFPA 257 for Window Assemblies.
  6. Manufacturers:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Approved Manufacturers:
        - (a) 5/16" thick, "Premium FireLite Plus" distributed by Technical Glass Products (800-426-0279).
        - (b) 5/16" thick, "SGG Keralite FR-L"; Vetrotech Saint-Gobain (888-803-9533)
        - (c) 5/16" thick, "PYRAN Star L"; Schott North America, Inc. (800-657-4439)
        - (d) 5/16" thick, "PYRAN Platinum L"; Schott North America, Inc. (800-657-4439)
- B. Fire-Protective, Filmed Glazing Material: Proprietary product in the form of one ply of clear ceramic flat sheet with clear safety film, permanently labeled with appropriate marks of testing and inspecting agency, acceptable to authorities having jurisdiction, showing product complies with fire-protective installation indicated, and as follows:
1. Safety Glass: Shall conform to ASTM C1048, and Federal Standard CPSC 16 CFR 1201.
  2. Polished on both surfaces, transparent with minimum visible light transmission of 85 percent.
  3. Positive Pressure: Shall meet requirements of positive pressure test standards UL 10C.
  4. NFPA 252 for Door Assemblies.
  5. NFPA 257 for Window Assemblies.
  6. Manufacturers:
    - a. Preferred Manufacturers:
      - 1) None
      - 2) Approved Manufacturers:
        - (a) 3/16" thick, "Superlite C/SP"; SAFTI First (800-653-3333)
        - (b) 3/16" thick, "FireLite NT" distributed by Technical Glass Products (800-426-0279).
        - (c) 3/16" thick, "SGG Keralite FR-F"; Vetrotech Saint-Gobain (888-803-9533)
        - (d) 3/16" thick, "PYRAN Star F"; Schott North America, Inc. (800-657-4439)
        - (e) 3/16" thick, "PYRAN Platinum F"; Schott North America, Inc. (800-657-4439)

## 2.05 DECORATIVE LAMINATED GLASS

- A. Manufacturers:
1. Preferred Manufacturers:
    - a. Glass Manufacturers
      - 1) None
      - 2) Interlayer Manufacturer:
        - (a) None
    - b. Approved Manufacturers:
      - 1) Glass Manufacturers
        - (a) Oldcastle Building Envelope (formally Vistawall) (866-653-2278)
        - (b) Viracon, Inc. (800-533-2080)
      - 2) Interlayer Manufacturer:

- (a) Solutia Inc. (877-674-1233)
    - (b) Approved Substitution.
  - B. Translucent Laminated Safety Glass with Decorative Interlayer
    - 1. Glass Materials:
      - a. Pane Thickness: 1/8-inch
      - b. Clear Float Glass: Clear, Type AN - annealed, ASTM C1036.
      - c. Interlayer Material:
        - 1) Vanceva Design by Solutia, PUB plastic interlayer ASTM C1172.
          - (a) Color: # 000F Polar White
          - (b) Transparency: Visible Light Transmittance 8%.
          - (c) Thickness: 0.030-inch minimum.
      - d. Laminated Glass - Safety Type
        - 1) Nominal Thickness: 1/4 inch.
        - 2) Double layers of 1/8" annealed glass with decorative interlayer between panes.
        - 3) Conform to Safety Regulations: ANSI Z97.1.

## **2.06 DECORATIVE LAMINATED GLASS**

- A. Manufacturers:
  - 1. Preferred Manufacturers:
    - a. None
    - b. Approved Manufacturers:
      - 1) Archetype Frameless Glass, Inc. (717-244-52408)
        - (a) Refer to Interior Finish Index for glass product.
- B. Decorative Laminated Safety Glass with Decorative Interlayer
  - 1. Glass Materials:
    - a. Pane Thickness: 3/8-inch
    - b. Conform to Safety Regulations: ANSI Z97.1.
- C. Refer to Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for framing system.

## **2.07 DECORATIVE FILM OVERLAY**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Type 1: "Fasara"; 3M Consumer Safety and Light Management (800-480-1704)
  - 2. Type 2: "Belbien"; Surfacequest, Inc. (952-361-9431)
- C. Color and Pattern: Refer to Interior Finish Index

## **2.08 DECORATIVE FILM OVERLAY**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Avery Dennison Graphics and Reflective Products Division (502-637-5079)
- C. Color and Pattern: Refer to Interior Finish Index

## **2.09 DECORATIVE FILM OVERLAY**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Designtex Bespoke GF12 Clear Polyester Window Film"; DesignTex, a Steelcase Company (800-221-1540)
- C. Fire Rating: ASTM E84 Class A
- D. Color and Pattern: Refer to Interior Finish Index

## 2.10 MIRRORS - UNFRAMED

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Binswanger Mirror, Division of Vitro America (800-238-6057)
  - 2. Guardian Consolidated, (276-236-5196)
  - 3. Gardner Glass Products (800-334-7267)
- C. Mirror glazing "select" quality float glass complying with ASTM C1036 and CPSC 16 CFR 1201, 1/4" thick.
- D. Silvering: Provide electro-deposited silvering in two coats.
- E. Exposed edges ground smooth and polished.
- F. Mirror sizes indicated on the drawings. Extend mirror to within 1" of adjacent walls, on each end, in one piece.
- G. Mirror Adhesive System:
  - 1. Preferred Manufacturers:
    - a. None
    - b. Approved Manufacturers:
      - 1) Edge Seal:
        - (a) "UC-4401" - PPG Industries Inc., Glass Group; (800-377-5267)
        - (b) "Seal-Kwik Edge Sealer" Gunther Mirror Mastics, a Royal Adhesives and Sealants, LLC Company (800-227-6181)
        - (c) Approved Substitution as recommended by mirror manufacturer.
      - 2) Adhesive:
        - (a) "Mirror-Mastic"; Palmer Products Corp (800-431-6151)
        - (b) "Premier Mirror Mastic" Gunther Mirror Mastics, a Royal Adhesives and Sealants, LLC Company (800-227-6181)
        - (c) Approved Substitution as recommended by mirror manufacturer.
      - 3) a.
        - (a) 1)
    - c. 1.
    - d. Provide products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy".
- H. Exposed Mirror Clips:
  - 1. Preferred Manufacturers:
    - a. None
    - b. Approved Manufacturers:
      - 1) Top Clip: 9/16" wide x 1-1/4" long; Model No. 318; Knappe & Vogt (800-253-1561)
      - 2) Bottom Channel: Continuous low profile channel at base.
      - 3) Approved substitution

## 2.11 ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES

- A. General: Provide products of type indicated and complying with the following requirements:
  - 1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
  - 2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.

3. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those for Type, Grade, Class and Uses.
  4. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Owner's Representative from manufacturer's standard colors.
- B. Preformed Butyl-Polyisobutylene Glazing Tape: Provide manufacturer's standard solvent-free butyl-polyisobutylene formulation with a solids content of 100 percent; complying with AAMA A 804.1; in extruded tape form; non-staining and non-migrating in contact with nonporous surfaces; packaged on rolls with a release paper on one side; with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated.
  - C. Sealants: Provide structural and weatherseal sealants recommended by the manufacturer of the glazing system.
    1. As manufactured by the following:
      - a. GE Silicones (800-255-8886)
      - b. Tremco, Inc., Sealant/Weatherproofing Division, an RPM Company (800-562-2728)
      - c. Refer to Section 07 92 00 (07920) - for requirements.
      - d. 1.
  - D. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Provide the curtain wall manufacturer's permanent nonmigrating types compatible with sealants and suitable for joint movement and sealing requirements.

## **2.12 MISCELLANEOUS GLAZING MATERIALS**

- A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.
- E. Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.
- F. Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.

## **EXECUTION**

**3.01 EXAMINATION: REQUIRE GLAZIER TO INSPECT WORK OF GLASS FRAMING ERECTOR FOR COMPLIANCE WITH MANUFACTURING AND INSTALLATION TOLERANCES, INCLUDING THOSE FOR SIZE, SQUARENESS, OFFSETS AT CORNERS; FOR PRESENCE AND FUNCTIONING OF WEEP SYSTEM; FOR EXISTENCE OF MINIMUM REQUIRED FACE OR EDGE CLEARANCES; AND FOR EFFECTIVE SEALING OF JOINERY. OBTAIN GLAZIER'S WRITTEN REPORT LISTING CONDITIONS DETRIMENTAL TO PERFORMANCE OF GLAZING WORK. DO NOT ALLOW GLAZING WORK TO PROCEED UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.**

**3.02 PREPARATION: CLEAN GLAZING CHANNELS AND OTHER FRAMING MEMBERS TO RECEIVE GLASS, IMMEDIATELY BEFORE GLAZING. REMOVE COATINGS WHICH ARE NOT FIRMLY BONDED TO SUBSTRATES. REMOVE LACQUER FROM METAL SURFACES WHERE ELASTOMERIC SEALANTS ARE INDICATED FOR USE.**

## **3.03 GLAZING - GENERAL**

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

- B. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- D. Anchor components securely in place in the manner indicated. Shim and allow for movement resulting from changes in thermal conditions. Provide separators and isolators to prevent corrosion, electrolytic deterioration, and "freeze-up" of moving joints.
- E. Glazing: Inspect glass and framing for compliance with manufacturing and installation tolerances, including size, squareness, and offsets at corners; for existence of minimum face or edge clearances; and for effective sealing of joinery.
  - 1. Avoid point loading of glass. Do not proceed with glazing work until unsatisfactory conditions have been corrected. Do not field-cut glass.
  - 2. Field-Glazed Structural Silicone Glazing Work: Clean frames and glass surfaces with an approved solvent. Prime surfaces and apply structural sealant in accordance with manufacturer's recommendations. Clean excess structural sealant before curing. Mechanically hold glass firmly in place until sealant is sufficiently cured. Install compressible backer rods in joint before applying weatherseal sealant.
- F. Erection Tolerances: Install curtain wall components plumb, level, accurately aligned, and located in reference to column lines and floor levels. Erection tolerances indicated below are the maximum allowable for both no-load and full-load conditions and are not cumulative. Adjust work to conform to the following tolerances:
  - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
  - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  - 3. Alignment: Limit offset of member alignment to 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by less than 3 inches by protruding work; otherwise limit offsets to 1/8 inch.
  - 4. Location: 3/8 inch maximum deviation from the measured theoretical location of any member at any location.

### **3.04 GLAZING - INSTALLATION**

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner, unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- D. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

### **3.05 DECORATIVE FILM OVERLAY - INSTALLATION**

- A. Preparation: Clean glass in accordance with manufacturer's recommendations.

- B. Apply to glass in accordance with manufacturer's recommendations. Installation shall be squarely aligned to glass edges and free of air bubbles, tears, wrinkles, and rough edges.

### **3.06 MIRROR - INSTALLATION**

- A. Do not install mirrors on new plaster, freshly painted walls, or where airborne solvents, heavy-duty cleaners, etc., are in the air. Sub-surfaces shall be allowed to cure for a minimum of 72 hours.
- B. Use exposed clips at top and continuous bottom clip at base of mirror.
- C. Seal bottom edges of mirror track with clear sanitary sealant. Refer to Section 07 92 00 (07920). Allow to dry.
- D. Apply adhesive to 60% of back of mirror.
- E. Set mirror supported by setting blocks and press against substrate to ensure bond of adhesive.
- F. Hold mirror in place until adhesive fully sets.

### **3.07 PROTECTION AND CLEANING**

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- E. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion.

**END OF SECTION**

**SECTION 09 21 16**  
**GYPSUM BOARD ASSEMBLIES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
1. Non-Load Bearing Interior Steel Framing
    - a. Interior Partitions
    - b. Suspended and Furred Ceilings
  2. Gypsum Board, Screw-Attached to Wood Framing and Furring Members, and Required Accessories
  3. Gypsum Board, Screw-Attached to Steel Framing and Furring Members, and Required Accessories
  4. Glass-Mat, Mold & Mildew Resistant Interior Wall Panel
  5. Sound Deadening Boards
  6. Exterior Cement Board Ceilings.
  7. Tile-Backer Boards
  8. Glass Fiber Reinforced Gypsum Soffits
  9. Clothes Dryer Recessed Vent Box.
  10. Patching and repairing existing Gypsum Board Walls or Ceilings.
- B. Related Sections:
1. Section 01 35 16 (01120) - Alteration Project Procedures
  2. Section 01 73 29 (01730) - Cutting and Patching.
  3. Section 02 41 19 (01738) - Selective Structure Demolition
  4. Section 05 40 00 (05400) - Cold-Formed Metal Framing
  5. Section 06 10 00 (06100) - Rough Carpentry
  6. Section 06 20 00 (06200) - Finish Carpentry
  7. Section 07 20 00 (07200) - Thermal Protection
  8. Section 07 84 00 (07480) - Firestopping
  9. Section 07 92 00 (07920) - Joint Sealants
  10. Section 09 21 16.23 (09265) - Gypsum Board Shaft-Wall Assemblies
  11. Section 09 30 00 (09310) - Tiling
  12. Section 09 94 13 (09941) - Textured Finishing
  13. Section 09 51 23 (09512) - Acoustical Tile Ceilings
  14. Section 09 72 00 (09950) - Wall Coverings
  15. Section 09 90 00 (09900) - Painting

**1.02 REFERENCES**

- A. American Iron and Steel Institute (AISI) Publications:
1. "AISI's Code of Standard Practice for Cold-Formed Steel Structural Framing"
  2. "North American Specification for the Design of Cold Formed Steel Structural Members"
- B. American National Standards Institute (ANSI) Publications:
1. A108/A118/A136.1 "American National Standards for the Installation of Ceramic Tile"
  2. A118.9 "Specifications for Cementitious Backer Units (included in ANSI A108)"
- C. ASTM International (ASTM) Publications:
1. A510 "Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel"
  2. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  3. A641 "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire"
  4. A1003 "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members"



5. C475 "Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board"
  6. C514 "Standard Specification for Nails for the Application of Gypsum Board"
  7. C557 "Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing"
  8. C645 "Standard Specification for Nonstructural Steel Framing Members"
  9. C754 "Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products"
  10. C834 "Standard Specification for Latex Sealants"
  11. C840 "Standard Specification for Application and Finishing of Gypsum Board"
  12. C919 "Standard Practice for Use of Sealants in Acoustical Applications"
  13. 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"
  14. C1002 "Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs"
  15. C1047 "Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base"
  16. C1177 "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing"
  17. C1178 "Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel"
  18. C1396 "Standard Specification for Gypsum Board"
  19. C1658 "Standard Specification for Glass Mat Gypsum Panels"
  20. D3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber"
  21. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
  22. E90 "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"
  23. E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"
  24. E413 "Classification for Rating Sound Insulation"
  25. E488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"
  26. E736 "Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members"
  27. E 759 "Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members"
  28. E761 "Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members"
- D. Gypsum Association (GA) Publications:
1. GA-214 "Recommended Levels of Gypsum Board Finish"
  2. GA-216 "Application and Finishing Of Gypsum Panel Products"
  3. GA-505 for definitions of terms for gypsum board assemblies not defined in this Section
  4. GA-600 "Fire Resistance Design Manual"
- E. FM Global (FMG):
1. "Approval Guide, Building Products"
- F. ICC Evaluation Service Reports:
1. ES-AC86 "Cold-formed Steel Framing Members---Interior Nonload-bearing Wall Assemblies"
- G. Underwriters Laboratory (UL):
1. "Fire Resistance Directory"
  2. 723 "Test for Surface Burning Characteristics of Building Materials"
- H. United States Gypsum Co. (USG):
1. "Gypsum Construction Handbook"
- I. U.S. Consumer Product Safety Commission (CPSC):
1. "CPSC Staff Preliminary Evaluation of Drywall Chamber Test Results" by the Lawrence Berkeley National Laboratory (LBNL).

### 1.03 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C1396 and GA-505 for definitions of terms for gypsum board construction not otherwise defined in this Section or other referenced standards.

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Asbestos Content: Provide written certification that materials contain no asbestos of any type of mixture of types occurring naturally as impurities as determined by polarized light microscopy test per Appendix A of 40 CFR 763 will be utilized on this Project.

### 1.05 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire-resistance rating has been determined per ASTM E119 by a testing and inspecting organization acceptable to authorities having jurisdiction.
  - 1. Provide fire-resistance-rated assemblies identical to those indicated by reference to GA 600 "Fire Resistance Design Manual", to design designations in U.L. "Fire Resistance Directory", to FMG's "Approval Guide, Building Products", or in listing of other testing and agencies acceptable to authorities having jurisdiction.
- B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.
- C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- E. Sound Transmission Characteristics: For gypsum board assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E90 and classified per ASTM E413 by a qualified independent testing agency.
- F. Gypsum board products shall contain low or no detectable emissions of hydrogen sulfide or other harmful chemicals as determined according to testing by the U.S. Consumer Product Safety Commission (CPSC)

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.
- D. Steel framing and related accessories shall be stored and handled in accordance with "AISI's Code of Standard Practice for Cold-Formed Steel Structural Framing".

### 1.07 PROJECT CONDITIONS

- A. Environmental Conditions, Gypsum Board, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations.

- B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg. F. For adhesive attachment and finishing of gypsum board maintain not less than 50 deg. F. for 48 hours prior to application and continuously thereafter until drying is complete. Do not exceed 95 deg. F when using temporary heat sources.
- C. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.
  - 1. Provide adequate ventilation to permit drying during curing.
- D. Environmental Conditions, Textured Finish: Comply with manufacturers recommendations as to environmental conditions under which coating can be applied.
  - 1. Maintain temperature at not less than 55 degrees F during installation.

## 1.08 PRODUCTS

### 1.09 STEEL FRAMING FOR INTERIOR PARTITIONS

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. ClarkDietrich Building Systems LLC (513-870-1100)
  - 2. Marino (800-627-4661)
- C. General: Provide steel framing members complying with the following requirements:
  - 1. Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C754 and ASTM C840 requirements that apply to framing installation under the following maximum deflection and lateral loading conditions:
    - a. Maximum Deflection: L/240 at 5 lb. per sq. ft.
    - b. Protective Coating: ASTM C645, G40 (Z120) hot-dipped galvanized steel, complying with ASTM A1003 or ASTM A653, or equivalent corrosion resistant coating. A40 gavannealed products are not acceptable.
- D. Steel Studs and Runners: ASTM C645, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
  - 1. Steel Studs and Runners:
    - a. Cold-formed with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return).
    - b. Flange Length: 1-1/4 inches.
    - c. Thickness: Minimum base metal (uncoated) thickness shall be [0.0179 inch] [0.027 inch] 0.0296 inch], unless otherwise indicated.
      - 1) Framing members certified by manufacturer to be third-party tested in accordance with ICC-ES AC86 and meeting ASTM C645, Section 9.2. Minimum base metal (uncoated) thickness shall be [0.0150 inch] [0.0179 inch] [0.0220 inch], unless otherwise indicated.
      - 2) Minimum base metal (uncoated) thickness shall be 0.033 inch at walls receiving tile finish in accordance with TCNA "Handbook for Ceramic Tile Installation."
      - 3) Minimum base metal (uncoated) thickness shall be 0.0333 inch at walls and ceilings receiving cementitious backer boards in accordance with ANSI A108.
  - 2. Depth: [2-1/2 inches] [and] [3-5/8 inches] [4 inches] [6 inches], unless otherwise indicated.
  - 3. Runners (Tracks):
    - a. Depth: Track web to match stud web size.
    - b. Thickness: Track thickness to match wall stud thickness, unless otherwise indicated.
- E. Furring:
  - 1. Steel Rigid Furring Channels: ASTM C645, hat shaped, depth and minimum thickness of base (uncoated) metal to be 0.0179 inch, unless otherwise indicated. Depth of [7/8] [1-1/2] inches.
  - 2. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission from steel sheet complying with ASTM A653 or ASTM A568 to form

1/2 inch deep x 2-5/8 inch channel with single or double-leg configuration. Minimum 25 gauge, pre-punched for screw attachment.

- F. Deflection Track: Manufacturer's standard top runner designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A653 or ASTM A568. Thickness as indicated for studs, and width to accommodated depth of studs.
- G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Approved Manufacturers:
    - a. "[BlazeFrame DSL] [MaxTrak] Slotted Deflection Track"; ClarkDietrich Building Systems LLC
    - b. Approved Substitution by listed manufacturers.
- H. Backing Plate: Proprietary fire-resistance-treated blocking and bracing in width indicated.
  - 1. Approved Manufacturers:
    - a. "Danback Fire-Treated Wood Backing Plate [D16F] [D24F]"; ClarkDietrich Building Systems LLC
    - b. Approved Substitution by listed manufacturers.
- I. U-Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
  - 1. Approved Manufacturers:
    - a. Cold-Formed U-Channel and "Easy-Clip U-Series Angle [U543] [U545] [U547]"; ClarkDietrich Building Systems LLC
    - b. Approved Substitution by listed manufacturers.
- J. Headers and Jambs: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges.
  - 1. Approved Manufacturers:
    - a. ["Heavy Duty Studs - HDS"] [and] ["Header Bracket - HDSC"] ["RedHeader RO"]; ClarkDietrich Building Systems LLC
    - b. Approved Substitution by listed manufacturers.
- K. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.
- L. Flexible Track:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Framing Contour Track (CNTB)"; ClarkDietrich Building Systems LLC (513-870-1100)
    - b. FLEX-ABILITY CONCEPTS (405) 996.5343
  - 3. Manufacturer's standard C-shaped flexible steel track with banded flanges and screw attachments at every flange interval fabricated from steel sheet complying with ASTM A653 or ASTM A568.
  - 4. Thickness: Minimum [0.019 inch (25 Gage)] [0.031 inch (20 gage)], unless otherwise indicated.

#### **1.10 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS**

- A. Manufacturers of Grid Suspension Systems
  - 1. Preferred Manufacturers:
    - a. None.
  - 2. Approved Manufacturers:

- a. Armstrong World Industries, Inc. (800-442-4212)
  - b. Chicago Metallic Corp. (800-323-7164)
  - c. ClarkDietrich Building Systems LLC (513-870-1100)
- B. General: Provide components complying with ASTM C754 for conditions indicated.
- C. Grid Suspension System for Interior Ceilings: ASTM C645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.
- D. Wire for Hangers and Ties: ASTM A641, Class 1 Zinc Coating, Soft Temper, minimum 0.162 inch diameter.
- E. Hanger Rods: ASTM A510 mild steel and zinc coated or protected with rust-inhibitive paint. Diameter as indicated.
- F. Channels: Cold-formed steel, 0.0538-inch-minimum thickness of base (uncoated) metal and 1/2-inch-wide flanges, and as follows:
  1. Carrying Channels: 2 inches deep, 590 lb. per 1,000 feet, unless otherwise indicated.
  2. Furring Channels: 3/4 inch deep, 300 lb. per 1,000 feet, unless otherwise indicated.
  3. Finish: G-60 hot-dip galvanized coating per ASTM A653 for framing for toilet rooms and where indicated.
    - a. Rust-inhibitive paint, unless otherwise indicated.
- G. Steel Studs for Furring Channels: ASTM C645, with flange edges bent back 90 deg. and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:
  1. Thickness: Minimum 0.0179 inch, unless otherwise indicated.
  2. Depth: 1-5/8" inch, unless otherwise indicated.
  3. Protective Coating: ASTM A653 or ASTM A1003, G40 Hot-Dip Galvanized Coating.
- H. Steel Rigid Furring Channels: ASTM C645, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:
  1. Thickness: Minimum 0.0179 inch, unless otherwise indicated.
  2. Protective Coating: Having a coating that provides equivalent corrosion resistance to G40 Hot-Dip Galvanized Coating per ASTM A653 or ASTM A1003.
- I. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A653 or ASTM A568 to form 1/2-inch-deep channel of the following configuration:
  1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single-slotted leg (web) or hat-shaped channel, with 1-1/2-inch-wide face connected to flanges by double-slotted or expanded-metal legs (webs).
  2. Preferred Manufacturers:
    - a. None
  3. Approved Manufacturers:
    - a. "Resilient Channel RC Deluxe (RCSD)"; ClarkDietrich Building Systems LLC (513-870-1100)
    - b. Approved Substitution
- J. Cast-in-Place and Post-installed Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing according to ASTM E488 conducted by a qualified independent testing agency.
  1. [Cast-in-place type designed for attachment to concrete forms]
  2. [Post-installed, chemical anchor]
  3. [Post-installed expansion anchor]

## 1.11 GYPSUM BOARD PRODUCTS

- A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize joints in each area and correspond with support system indicated.

1. Thickness: Provide gypsum board in widths of 48 inches and thickness indicated or, if not otherwise indicated, in 5/8 inch thickness to comply with ASTM C840 for application system and support spacing indicated.
- B. Gypsum Wallboard: ASTM C1396 and as follows:
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. G-P Gypsum Corporation (800-225-6119)
    - b. National Gypsum Company. (800-628-4662)
    - c. United States Gypsum Co. (800-950-3839)
    - d. CertainTeed Corporation, a subsidiary of Saint-Gobain (800-233-8990)
    - e. Continental Building Products (Lafarge North America Inc.) (866-349-7786)
    - f. Temple-Inland Forest Products Corp. - Gypsum Products (800-231-6060)
  3. [Type: Regular for vertical surfaces, unless otherwise indicated]
  4. Type: Type X [where required for fire-resistance-rated assemblies].
  5. Type: Type C [where required for fire-resistance-rated assemblies] [where required for sound rated wall assemblies].
  6. Type: Sag-resistant Type for Ceiling Surfaces
  7. Edges: Tapered and Featured (rounded or beveled) for prefilling.
- C. Glass-Mat, Mold & Mildew Resistant Interior Wall Panel
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "DensArmor Plus Interior Guard"; G-P Gypsum Corporation (800-225-6119)
    - b. "GreenGlass Interior Gypsum Board"; Temple-Inland Forest Products Corp. - Gypsum Products (800-231-6060)
    - c. "Sheetrock Brand Glass-Mat Panels Mold Tough Firecode X"; United States Gypsum Co. (800-950-3839)
  3. ASTM C1658, glass-mat faced, enhanced mold & mildew resistant gypsum core wallboard. Conforming to the physical properties of ASTM C1396 and ASTM C1177. Rating of 10 "No Mold Growth" as tested for 4 weeks according to ASTM D3273.
    - a. Surfaces to be Painted: Coated inorganic glass mat-faced back front.
    - b. Surfaces to be covered with Wallcovering or other finish: Coated inorganic glass mat-faced back and front.
  4. Core: [As indicated] [1/2 inch, regular type] [5/8 inch, Type X]
  5. Long Edges: [Tapered].
- D. Flexible Gypsum Wallboard: ASTM C1396, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.
1. Thickness: 1/4 inch
  2. Long Edges: Tapered.
  3. Location: [As indicated] [Apply in double layer at curved assemblies].
- E. Tile-Backer Boards
1. Glass-Mat, Water-Resistant Gypsum Backing Board: ASTM C1178, of type and thickness indicated below:
    - a. Type and Thickness: Regular, [1/2 inch][5/8-inch] thick, unless otherwise indicated.
    - b. Type and Thickness: Type X, 5/8 inch thick, where required for fire-resistance-rated assemblies and where indicated.
  2. Preferred Manufacturers:
    - a. None
  3. Approved Manufacturers:
    - a. "Dens-Shield TileGuard"; G-P Gypsum Corporation (800-225-6119)
    - b. "Diamondback GlasRoc Tile Backer"; CertainTeed Corporation, a subsidiary of Saint-Gobain (800-233-8990)

- F. Cement Board: ANSI A118.9.
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "DUROCK Cement Board"; United States Gypsum Co (800-950-3839)
    - b. "Wonderboard"; Custom Building Products (800-272-8786)
    - c. "PermaBase"; National Gypsum Company. (800-628-4662)
  - 3. Thickness: As shown on Drawings.
- G. Sound Damping Composite Gypsum Board:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "QuietRock"; Serious Materials Inc. (800-797-8159)
      - 1) "QuietRock 527": 5/8-inch, Type X.
      - 2) "QuietRock ES": 5/8-inch, Type X.
      - 3) QuietRock Dens ArmorPlus 528": 5/8-inch, Type X Mold Resistant, Glass-faced.
    - b. "Gold Bond SoundBreak XP Gypsum Board"; National Gypsum Company. (800-628-4662)
      - 1) 5/8-inch, Type X.
    - c. "SilentFX Noise Reducing Gypsum Board"; CertainTeed Corporation, a subsidiary of Saint-Gobain (800-233-8990)
      - 1) 5/8-inch, Type X.

#### 1.12 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C1047 and requirements indicated below:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturer
    - a. "Paper Faced Metal Bead and Trim Series" United States Gypsum Co (800-950-3839)
    - b. "Goldline Platinum Tape-On Drywall Trims"; ClarkDietrich Building Systems LLC (513-870-1100)
    - c. No Substitutions
  - 3. Material: Formed metal combined with paper, with metal complying with the following requirement:
    - a. Sheet steel zinc-coated by hot-dip process.
  - 4. Shapes indicated below by reference to Fig. 1 designations in ASTM C1047:
    - a. Cornerbead on outside corners, unless otherwise indicated.
    - b. LC-bead (J-Bead) with both face and back flanges; face flange formed to receive joint compound. Use LC-beads at exposed panel edges unless otherwise indicated.
    - c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
    - d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
    - e. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening. Use where indicated.
  - 5. Vinyl Trim Members
    - a. Preferred Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) Trim-Tex Inc.; (800-874-2333)
    - c. Performance Requirements:
      - 1) Furnish materials with at least 50 percent recycled content.

- 2) Self-Extinguishing: Shall not continue to support combustion once flame source is removed.
- 3) Impervious to rust, galvanic corrosion, electrolysis and resistant to most chemicals.
- d. Meet or exceed following Standards:
  - 1) Achieve Class A rating for Smoke and Flame Spread per ASTM E84.
  - 2) ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard.
  - 3) ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPCV) Compounds.
  - 4) ASTM D3678 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Interior-Profile Extrusions.
  - 5) Gypsum Association (GA): GA-216 - Gypsum Association
- e. Shapes and sizes: As shown on Drawings
- f. Color: Refer to the Interior Finish Index.
6. Wall Reveal: Metal edge trims to provide reveal in gypsum board.
  - a. Extruded aluminum or plastic trim at gypsum board walls or ceilings. Refer to details on Drawings.
  - b. Preferred Manufacturers:
    - 1) None
  - c. Approved Manufacturer
    - 1) "SWR-050U-050"; Pittcon Softforms, LLC (800-637-7638)
    - 2) "F Reveal Molding DRMF-50-50"; Fry Reglet Corporation (800-237-9773)
  - d. Material:
    - 1) Reveal Depth: 1/2"
    - 2) Reveal Width: 1/2"
  - e. Color: Factory Primed.
7. Curved Trim: Metal edge trims to provide inside and outside curves.
  - a. Flexible metal trim at curved track in gypsum board ceilings. Refer to details on Drawings.
  - b. Preferred Manufacturers:
    - 1) None
  - c. Approved Manufacturer
    - 1) "STF Series-Flexible Trim"; by Pittcon Softforms, LLC (800-637-7638)
  - d. Material:
    - 1) Face dimension: 7/8"
    - 2) Edge dimension: 5/8"
8. Curved Ceiling Reveal Trim: Metal edge trims to provide transition from gypsum board to acoustical ceiling tile system.
  - a. Curved anodized aluminum trim at gypsum board ceilings or bulkheads. Refer to details on Drawings.
  - b. Preferred Manufacturers:
    - 1) None
  - c. Approved Manufacturer
    - 1) "W Reveal Molding WDM-75-75"; by Fry Reglet Corporation (800-237-9773)
  - d. Material:
    - 1) Reveal Depth: 3/4"
    - 2) Reveal Width: 3/4"
  - e. Color: Match Acoustical Ceiling Tile Grid.
- B. Zinc Accessories for Exterior Installations: Corner beads, edge trim, and control joints formed from rolled zinc complying with ASTM C1047, in shapes indicated below by reference to ASTM C1047:
  1. Corner bead on outside corners, unless otherwise indicated.
  2. Shape LC-Bead (J-Bead), use at exposed panel edges, unless otherwise indicated.



3. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening. Use where indicated.
- C. Clothes Dryer Recessed Vent Box:
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "The Dryerbox Model [DB-425][DB-350]"; In-O-Vate Technologies, Inc. (888-443-7937)
  3. Recessed 22 gage molded steel dryer box for use in providing a receptacle in the wall to house dryer flex transition hose. Dryer Box shall be approved as a UL Through Penetration Firestop receptacle where required for use in fire-rated assemblies.

### 1.13 JOINT TREATMENT MATERIALS

- A. General: Provide materials complying with ASTM C475, ASTM C840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.
- B. Joint Tape: ASTM C475, 2-inch nominal width, paper reinforcing tape, unless otherwise indicated.
- C. Joint Compound for Interior Gypsum Board
1. General: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats. Products shall not contain asbestos.
  2. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
    - a. Preferred Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) "SHEETROCK Brand DURABOND Setting-Type Joint Compounds"; United States Gypsum Co. (800-950-3839)
      - 2) "SHEETROCK Brand Easy Sand Lightweight Setting-Type Joint Compounds"; United States Gypsum Co. (800-950-3839)
      - 3) "ToughRock Setting Compounds"; G-P Gypsum Corporation (800-225-6119)
      - 4) "ToughRock Sandable Setting Compounds"; G-P Gypsum Corporation (800-225-6119)
      - 5) "Lafarge Rapid Joint Lightweight Setting Compound"; Continental Building Products (Lafarge North America Inc.) (866-349-7786)
      - 6) "ProForm Brand Sta-Smooth Joint Compound"; National Gypsum Company. (800-628-4662)
      - 7) "ProForm Brand Sta-Smooth Lite Joint Compound"; National Gypsum Company. (800-628-4662)
  3. Drying Type Joint Compound: Vinyl type factory pre-mixed compound; formulated for uses indicated.
    - a. Preferred Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) "SHEETROCK Brand All-Purpose Joint Compound"; United States Gypsum Co. (800-950-3839)
      - 2) "SHEETROCK Brand Plus 3 Lightweight All-Purpose Joint Compound"; United States Gypsum Co. (800-950-3839)
      - 3) "ToughRock Ready-Mix All-Purpose Joint Compound"; G-P Gypsum Corporation (800-225-6119)
      - 4) "ToughRock Lightweight Joint Compound"; G-P Gypsum Corporation (800-225-6119)
      - 5) "Lafarge Rapid Coat All Purpose Compound"; Continental Building Products (Lafarge North America Inc.) (866-349-7786)

- 6) "ProForm Brand All Purpose Joint Compound"; National Gypsum Company.  
(800-628-4662)
  - 7) "ProForm Lite Ready Mix Joint Compound"; National Gypsum Company.  
(800-628-4662)
4. Joint Compound for Paper Faced Gypsum Board:
    - a. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
    - b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type topping, or non-lightweight drying-type all purpose compound.
    - c. Fill Coat: For second coat, use setting-type, sandable topping or drying-type all purpose compound.
    - d. Finish Coat: For third coat, use setting-type, sandable topping or drying-type all purpose compound.
    - e. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping or drying-type all purpose compound.
  5. Joint Compound for Glass-Mat Faced Gypsum Board:
    - a. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
      - 1) For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
      - 2) Apply water resistant tile adhesive to all cut or exposed edges, utility holes, and joints including those at wall intersections when installing moisture-resistant gypsum board panels.
    - b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - c. Fill Coat: For second coat, use setting-type, sandable topping compound.
    - d. Finish Coat: For third coat, use setting-type, sandable topping compound.
    - e. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Spray-Applied Skim Coat Primer-Surfacer:
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Sheetrock Brand Tuff-Hide Primer-Surfacer"; United States Gypsum Co.  
(800-950-3839)
    - b. No substitutions
  3. Provide spray-applied dual-purpose acrylic latex-based coating, in lieu of skim coat of joint compound for Level 5 gypsum board finish at the following locations:
    - a. Pubic lobby area
    - b. Glass-Mat, Mold & Mildew Resistant Interior Wall Ceiling Panels where glass mat facing is exposed, over Level 5 Skim Coat.
    - c. Other locations as shown on the Drawings
  4. Contractor's option to use this product at other areas requiring Level 5 gypsum board finish.

#### 1.14 CEMENT BOARD ACCESSORY MATERIALS

- A. Fasteners: Provide the kind, type, and size recommended by the cement board manufacturer for the application shown.
- B. Joint Reinforcement: 2-inch wide glass fiber, open-weave tape, Durock Type P, as manufactured by United States Gypsum Co., or approved substitution.
- C. Joint sealer and joint compound as recommended by manufacturer for the application shown.

### 1.15 ACOUSTICAL SEALANT

- A. Preferred Manufacturers:
  - 1. Acoustical Sealant for Exposed and Concealed Joints:
    - a. None
- B. Approved Manufacturers:
  - 1. Acoustical Sealant for Exposed and Concealed Joints:
    - a. Approved Manufacturers:
      - 1) "AC-20 FTR Acoustical and Insulation Sealant"; Pecora Corp. (800-523-6688) / VOC Level: 31 g/L.
      - 2) "SHEETROCK Acoustical Sealant"; United States Gypsum Co. (800-950-3839) / VOC Level: 65 g/L.
- C. Latex Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834 and the following requirements:
  - 1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E90.
  - 2. Product has flame-spread and smoke-developed ratings of less than 25 per ASTM E84.

### 1.16 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum drywall construction which comply with referenced installation standards and the recommendations of the manufacturer of the gypsum board.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum boards to continuous substrates.
- C. Spot Grout: ASTM C475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.
- D. Fastening Adhesive for Wood: ASTM C557.
- E. Fastening Adhesive for Metal: Special adhesive recommended for attaching gypsum panels to steel framing.
- F. Steel drill screws complying with ASTM C1002 for the following applications:
  - 1. Fastening gypsum board to steel members less than 0.03 inch thick.
  - 2. Fastening gypsum board to wood members.
  - 3. Fastening gypsum board to gypsum board.
- G. Steel drill screws complying with ASTM C954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.
- H. Gypsum Board Nails: ASTM C514.
- I. Water: All water used in joint system shall be clean and free from deleterious amounts of foreign material.
- J. Other Materials: All other materials not specifically described but required for a complete and proper installation of gypsum drywall shall be as selected by the Contractor, subject to approval by the [Architect] [Owner's representative].

### 1.17 GLASS FIBER REINFORCED SOFFITS

- A. Manufacturers:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. Formglas Inc. (416-635-8030)
- B. Steel Framing Components
  - 1. Framing Components: As indicated and that comply with steel framing components specified in this Section.

2. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, 0.162-inch diameter.
  3. Hanger Rods: Mild steel and zinc coated or protected with rust-inhibitive paint.
  4. Flat Hangers: Mild steel and zinc coated or protected with rust-inhibitive paint.
  5. Channels: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, and as follows:
    - a. Carrying Channels: [2 inches deep, 590 lb/1000 feet] [1-1/2 inches deep, 475 lb/1000 feet], unless otherwise indicated.
    - b. Furring Channels: 3/4 inch deep, 300 lb/1000 feet, unless otherwise indicated.
    - c. Finish: [Rust-inhibitive paint] [ASTM A653, G60 hot-dip galvanized coating].
  6. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190 conducted by a qualified independent testing agency.
  7. Steel Studs and Runners: ASTM C645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- (5-mm-) wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
    - a. Thickness: As indicated.
    - b. Depth: As indicated.
    - c. Protective Coating: ASTM A653 or ASTM A1003, G40 hot-dip galvanized coating.
  8. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing members securely to substrates.
- C. Glass-Reinforced Gypsum Fabrication Materials
1. Glass-Reinforced Gypsum Fabrications: ASTM C1355.
    - a. Properties:
      - 1) Shell Thickness: 1/8" to 3/16", as shown on Drawings.
      - 2) Perimeter Edge Thickness: 3/4" or 1", as shown on Drawings.
      - 3) Weight (depending on reinforcing): 2 - 3 lbs/sf.
      - 4) Density: 110 lbs/sf.
      - 5) Ultimate Tensile Strength: 1200 - 1400 psi.
      - 6) Modulus of Elasticity in Tension: 2.7 - 3.8 x 10<sup>6</sup> psi.
      - 7) Modulus of Elasticity in Flexure: 2.1 - 2.2 x 10<sup>5</sup> psi.
      - 8) Flame Spread, Smoke Index & Fuel Contribution (ASTM E84): 0
  2. Embedments: As standard with glass-reinforced gypsum fabrication manufacturer and as required for reinforcement and for anchorage to substrates and framing.
- D. Auxiliary Materials
1. Adhesives: As recommended in manufacturer's written instructions.
  2. Steel Drill Screws: Provide fasteners, complying with the following requirements, that are of sufficient length and size to securely fasten gypsum-reinforced fabrications to framing members:
  3. Joint Treatment Materials: Provide materials complying with ASTM C475 and with the recommendations of the manufacturers of both glass-reinforced gypsum fabrications and joint treatment materials for each application indicated.
  4. Control Joints: One-piece control joint with V-shaped slot and removable strip covering slot opening, formed from steel sheet zinc-coated by hot-dip process or from rolled zinc, and complying with ASTM C1047.
- E. Fabrication
1. Fabricate glass-reinforced gypsum units from molds constructed of rigid materials that will result in smooth-finished surfaces conforming to profiles, dimensions, and tolerances indicated. Provide units as large as practical to minimize joints.
  2. Remove units from molds and repair hollows, voids, scratches, and other surface imperfections.

3. Material Compatibility: Fabricate glass-reinforced gypsum fabrications with surface characteristics required for a high-gloss paint finish.
4. Embedments: Incorporate embedments so they develop the full strength of glass-reinforced gypsum fabrications. Cover embedments with glass-reinforced gypsum composite not less than 3/16 inch thick.
5. Connection Hardware: Custom designed and fabricated to support and connect glass-reinforced gypsum fabrications to hangers, support framing, and substrates.
6. Dimensional Tolerances of Units: As follows:
  - a. Factory-Finished Edge Straightness: Plus or minus 1/8 inch.
  - b. Plane Surface Straightness: Plus or minus 1/8 inch.
  - c. Overall Assembled Length and Width: Plus or minus 1/8 inch per 10 feet .
  - d. Chords, Radii, and Diameters: Plus or minus 1/8 inch.
  - e. Squareness: Not more than 1/4-inch difference between diagonals in 16 sq. ft.

#### **1.18 EXECUTION**

#### **1.19 EXAMINATION**

- A. Examine substrates with Installer present, to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### **1.20 CEILING ANCHORAGES**

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

#### **1.21 INSTALLATION - STEEL FRAMING, GENERAL**

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.
- B. Install supplementary fire-treated wood framing, blocking, and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.
- C. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing of furring members or as indicated.
- D. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

#### **1.22 INSTALLATION - STEEL FRAMING FOR WALLS AND PARTITIONS**

- A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from plane of faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
- D. For STC-rated and fire-resistive-rated partitions requiring partitions to extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as

needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

1. Terminate partition framing at suspended ceilings where indicated.
- E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.
  1. For single-layer construction: [16 inches] on center.
- F. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.
- G. Frame door openings to comply with details indicated, with GA 216 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws, wither directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
- H. Curved Partitions:
  1. Cut top and bottom track (runners) through leg and web at 2-inch intervals for arc length. In cutting lengths of track, allow for uncut straight lengths of not less than 12 inches at ends of arcs.
  2. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
  3. Support outside (cut) leg of track by clinching steel sheet strip, 1-inch-high-by-thickness of track metal, to inside of cut legs using metal lock fasteners.
  4. Install flexible track system in accordance with track manufacturer's recommendations.
  5. Begin and end each arc with a stud, and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.
  6. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.
- I. Install thermal insulation as follows:
  1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches on center.
  2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or power-driven fasteners spaced 24 inches on center.
  3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner. On adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
  4. Until gypsum board is installed, hold insulation in place with 10 inch staples fabricated from 0.0625 inch (16 gauge) diameter tie wire and inserted through slot in web of member.

### **1.23 INSTALLATION - STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS**

- A. Screw furring members to metal framing.
- B. Suspend ceiling hangers from building structural members and as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
  3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate,

- and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure, as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  5. Do not attach hangers to steel deck tabs.
  6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  7. Do not connect or suspend steel framing from ducts, pipes or conduit.
  8. Sway-brace suspended steel framing with hangers used for support.
- C. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard.
1. Wire Hangers: 0.1620-inch (8-gauge) diameter, 4 feet o.c.
  2. Carrying Channels (Main Runners): 1-1/2, 4 feet o.c.
  3. Rigid Furring Channels (Furring Members): 16 inches o.c.
  4. Rigid Furring Channels (Furring Members): 24 inches o.c.
- D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.
- E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.
- F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

#### **1.24 INSTALLATION - CEMENT BOARD**

- A. Install cement board on ceiling suspension system in locations shown on Drawings. Install to soffit vent moldings at perimeters. Apply long dimension parallel to or across framing. Center end or edge joints on framing and stagger joints in adjacent rows. Fit ends closely, but not forced together.
- B. Fasten to framing per manufacturer's recommendations for fastening, but do not exceed 6 inches o.c. spacing. Space perimeter fasteners at least 3/8" from edge of board.

#### **1.25 INSTALLATION - GLASS FIBER REINFORCED SOFFITS**

- A. Steel Framing Installation
1. Steel Framing Installation Standard: Install steel framing to comply with ASTM C754 and with details indicated. Select framing components of type, size, and spacing needed to support weight of glass-reinforced gypsum fabrications and to maintain erection tolerances.
  2. Supplementary Framing, Blocking, and Bracing: Install supplementary framing as required not only to support glass-reinforced gypsum fabrications but also fixtures and other items penetrating glass-reinforced gypsum fabrications.
- B. Glass-Reinforced Gypsum Fabrication Installation
1. Install glass-reinforced gypsum fabrications level, plumb, true, and aligned with adjacent materials. Use concealed shims where required for alignment.
    - a. Lift units with suitable devices as recommended by manufacturer.
  2. Predrill fastener holes in glass-reinforced gypsum fabrications. Clean fastener holes to remove dirt and oil.
  3. Attach glass-reinforced gypsum fabrications to framing and substrates with steel drill screws. Do not use pneumatic staple guns. Countersink screw heads below adjoining finished surface.
  4. Fasten as required to comply with dimensional tolerances and not less than 5/16 inch from edge to end.

5. Cover screw heads with joint compound to produce flush, smooth, and level finished surfaces.
  6. Attach glass-reinforced gypsum fabrications at joints with adhesive, and band or brace together until adhesive is cured. Cure adhesive according to glass-reinforced gypsum fabrication manufacturer's written instructions.
  7. Install control joints where indicated.
  8. Joint Finishing: Comply with ASTM C840 for the following finish level:
    - a. Level 5.
- C. Erection and Location Tolerances
1. Erection Tolerances: Install glass-reinforced gypsum fabrications so each unit complies with the following dimensional requirements:
    - a. Plane Alignment (Panel to Panel): 1/16 inch.
    - b. Variation from Plumb: Plus or minus 1/8 inch per 10 feet.
    - c. Variation from Straightness: Plus or minus 1/4 inch per 25 feet.
    - d. Assembly Deflection: Not greater than the length of the assembly divided by 240.
    - e. Joint Alignment: Not more than 1/8 inch.
    - f. Joint Width: Not more than 3/8 inch.

#### **1.26 APPLICATION AND FINISHING OF GYPSUM BOARD, GENERAL**

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum board to comply with ASTM C840 and GA-216.
- B. Install sound attenuation blankets where indicated, prior to gypsum board unless readily installed after board has been installed on one side.
- C. Locate exposed end-butt joints as far from center of walls and ceilings as possible and stagger not less than 24 inches in alternate courses of board.
- D. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches, but not less than one framing member.
- E. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Gypsum boards shall extend tight to floors and ceilings with no gaps.
- F. Install exposed gypsum board with face side out. Do not install imperfect, damaged, or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.
- G. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- H. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flanged first.
- I. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- J. Form control joints and expansion joints at locations indicated, with space between edges of boards, prepared to receive trim accessories. If not shown on Drawings, control joints shall be installed as follows, in locations as approved by [Architect] [Owner's Representative]:
  1. A control joint shall be installed where a partition, wall, or ceiling traverses a construction joint (expansion, seismic, or building control element) in the base building structure.
  2. Control joints shall be installed where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet.



3. Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 feet and total area between control joints does not exceed 2500 sq. ft.
  4. Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30 feet and total area between control joints does not exceed 900 sq. ft.
  5. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
- K. Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material consisting of 5/8" type X gypsum board.
- L. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.
- M. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C919 and manufacturer's recommendations for location of edge trim and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.
- N. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

## **1.27 INSTALLATION - GYPSUM BOARD**

- A. Single-Layer Application: Install gypsum wallboard as follows:
1. On ceilings, apply gypsum board prior to wall/partition board application to the greatest extent possible, and at right angles to framing, unless noted otherwise.
  2. On partitions/walls, apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
- B. Multi-layer Application: Install gypsum backing board for base layer and gypsum wallboard for face layer.
1. On ceilings, apply base layer prior to applying base layer on walls/partitions; apply face layers in same sequence. Offset face-layer joints one framing member, but not less than 16 inches from parallel base-layer joints. Apply base layers at right angles to framing members unless otherwise indicated.
  2. On partitions/wall, apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset at least, one stud or furring member, not less than 10 inches with base layer joints.
  3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- C. Single-Layer Fastening Methods: Apply gypsum boards to supports with steel drill screws.
- D. Multi-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:
1. Fasten both base layers and face layers separately to supports with screws.
- E. Direct-Bonding (Laminating) to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- F. Install gypsum wallboard panels with tapered edges taped and finished to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- G. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
1. Install water-resistant Tile-Backer Board panels at [all areas] [showers, tubs, and where indicated] to receive tile.

2. Tile Backing Panels:
  - a. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at [showers, tubs, indoor pools, and where indicated] [locations indicated to receive tile]. Install with ¼ inch gap where panels abut other construction or penetrations.
  - b. Cementitious Backer Units: ANSI A108.11, at [showers, tubs, indoor pools, and where indicated] [locations indicated to receive tile].
  - c. Guestroom Bath Areas Not Subject to Wetting: Install Glass-Mat, Mold & Mildew Resistant Interior Wall Panel to product a flat surface except at locations to receive water-resistant backing panels.
  - d. All Other Areas Not Subject to Wetting: Install standard gypsum wallboard panels to product a flat surface, except at locations to receive water-resistant backing panels or Glass-Mat, Mold & Mildew Resistant Wall Panels.
  - e. Where tile backing panels abut other types of panels in the same plane, shim surface to produce a uniform plane across panel surfaces.
- H. Curved Partitions:
  1. Install panels horizontally and unbroken, to the extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
  2. Wet gypsum panels on surfaces that will become compressed where curve radius prevents using dry panels. Comply with gypsum board manufacturer's written recommendations for curve radii, wetting methods, stacking panels after wetting, and other preparations that precede installing wetted gypsum panels.
  3. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches o.c.
  4. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
  5. Allow wetted gypsum panels to dry before applying joint treatment.

## 1.28 INSTALLATION - TRIM ACCESSORIES

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.
  1. Install vinyl trim members in accordance with manufacture's written installation instructions. When manufacturer's installation instructions do not specifically cover applicable installation; comply with ASTM C754, Gypsum Association (GA) GA-216 and GA-600.
    - a. Secure trim members to substrate with staples and spray adhesive in accordance with trim manufacturer's written instructions.
    - b. Install factory fabricated accessories at joints in trim members with durable:
      - 1) Straight edges.
      - 2) Straight corners.
      - 3) Smooth curvatures.
      - 4) True arches.
  2. Install corner beads at external corners.
- B. Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
- C. Install edge trim where edge of gypsum board would otherwise be exposed or semi-exposed. Provide edge trim-type with face flange to receive joint compound except where other types are indicated.
  1. Install "LC" bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

2. Install "L" bead where edge trim can only be installed after gypsum board is installed.
3. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

### **1.29 FINISHING OF GYPSUM BOARD ASSEMBLIES**

- A. General: Apply joint treatment at gypsum board joints (both directions), flanges of corner bead, edge trim, and control joints, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration and level of gypsum board finish indicated.
  1. Prefill open joints, rounded or beveled edges, and damaged areas, using setting-type joint compound.
  2. Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.
- B. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
  1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
  2. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
  3. Level 4 for gypsum board surfaces indicated to receive light-textured finishes, wallcoverings, and flat paints over light textures.
  4. Level 4 for gypsum board surfaces indicated to receive gloss and semi-gloss enamels, nontextured flat paints, and where indicated.
  5. Level 5 for gypsum board exposed ceilings to receive paint, or wall surfaces indicated to receive graphic wall covering murals.
- C. For Level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using one of the following combinations of joint compounds (not including prefill), and sand between coats and after last coat.
- D. Where Level 5 gypsum board finish is indicated, apply joint compound combination specified for Level 4 plus a thin, uniform skim coat of joint compound over entire surface. Use joint compound specified for the finish (third coat) or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Produce surfaces free of tool marks and ridges ready for decoration of type indicated.
- E. Where Level 2 gypsum board finish is indicated, apply joint specified for first coat in addition to embedding coat.
- F. Where Level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.
- G. Allow not less than 24 hours drying time between coats.
- H. Glass-Mat Gypsum Interior Wall Panel:
  1. Finish according to manufacturer's written instructions for use in interior applications.

### **1.30 PATCHING EXISTING INTERIOR GYPSUM BOARD**

- A. General:
  1. Provide for patching of existing construction cut or otherwise damaged or defaced as a result of selective structure demolition operations or the cutting, fitting, and installation of new work.
  2. Perform cutting and patching using materials specified for new work. Select materials to match existing materials and as required to provide results indicated.
  3. Provide for replacement of existing materials and construction when results of patching and refinishing existing construction will not be satisfactory, and as necessary to achieve finished surfaces indicated.

4. Replace materials comprising fire-rated or smoke-rated assemblies when damaged beyond repair or where repairs cannot be made in compliance with the assembly listing. Comply with listed assembly requirements as stated in the listing.
  5. Finish repairs and replacements as required to receive finish materials indicated and so that final finished surface matches existing adjacent surfaces. Refinish entire wall or ceiling surfaces as necessary to comply with surface preparation requirements of finish materials indicated for each surface.
  6. Patched or repaired areas shall be indiscernible existing adjacent surfaces by sight or touch when finishing work, is complete.
- B. Repair Procedures:
1. Cut out and remove gypsum board having damage extending more than half way through the thickness of the board.
  2. Where wiring and electrical junction boxes are being removed or added, walls may require patching.
  3. Provide additional framing so that gypsum board patch has a minimum of 2 sides screw attached.
  4. Cut damaged paper facing with knife and remove loose and damaged materials.
  5. Install patch cut from same type and thickness of gypsum board as existing. Size and fit patch to leave 1/8-inch joints, maximum.
    - a. Install and finish gypsum board in conformance with ASTM C840 and GA-216.
    - b. Screws:
      - 1) Locate 3/8-inch minimum from edges or ends of panel. Power-driven to provide uniform dimple 1/32-inch deep.
      - 2) Space screws 8-inches o.c. in field of panels and 6-inches o.c. along vertical abutting edges.
  6. Metal Trim:
    - a. Replace damaged metal trim.
    - b. Fasten with screws or 9/16-inch galvanized staples 9-inches o.c.
  7. Corner Beads:
    - a. Replace damaged corner beads.
    - b. Fasten with screws or 9/16-inch galvanized staples 9-inches o.c. on both flanges along entire length of bead.
  8. Apply joint compound in 1/8-inch maximum coats to gypsum board having minor damage extending less than halfway through board. Allow compound to set between coats.
  9. Apply joint tape and compound system to untrimmed joints between gypsum boards and patches, including interior corners, and finish smooth and level with gypsum board faces leaving surface suitable for wall finish.
  10. Apply joint compound to trim, and fastener heads. Finish smooth and level with partition face leaving surface suitable for wall finish.
  11. Restore or replace finish as indicated on the Drawings.

### **1.31 SPRAY APPLIED SKIM COAT PRIMER SURFACER APPLICATION**

- A. Preparation:
1. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
    - a. After completing coating operations in each area, reinstall items removed using workers skilled in trades involved.
  2. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.
    - a. Schedule cleaning and coating application so dust and other contaminants from cleaning operations will not fall on wet, newly coated surfaces.

3. Surface Preparation: Clean and prepare surfaces to be coated according to the manufacturer's written instructions for the particular substrate conditions, and as specified.
  - a. Gypsum Board Preparation:
    - 1) Treat joints and fastener heads in accordance with United States Gypsum Co instructions for a minimum Level 4 wallboard finish.
    - 2) Fill and smooth scratches and scuffs in gypsum board surfaces.
    - 3) Allow gypsum board joint treatment and fillers to thoroughly dry before application.
  - b. Install sealant in joints. Refer to Section 07 92 00 (07920).
  - c. Material Preparation: Carefully mix and prepare materials according to the manufacturer's written instructions.
- B. Application:
  1. General: Apply finish to exposed surfaces indicated.
    - a. Primer-Surfacers Application: Mix and apply finish to gypsum panels indicated to receive finish according to finish manufacturer's directions. Using power spray equipment acceptable to finish manufacturer, produce a uniform thickness, free of starved spots, pin-holes, or other evidence of thin application or of application patterns, and free of excessive globules.
    - b. Prevent spray-applied finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If despite these precautions, finishes contact these surfaces, immediately remove droppings and overspray as recommended by finish manufacturer to prevent damage.
    - c. Color to be White.
- C. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate. Provide total cured material thickness indicated or as recommended by the manufacturer.

### **1.32 CEMENT BOARD FINISHING**

- A. Seal cement board per manufacturer's recommendations.
- B. Embed fiberglass reinforcement tape over joints and treat fasteners with joint compound as specified in Paragraph 3.11.
- C. Do not apply joint treatment over unsealed board.
- D. Apply skim coating of "Durabond 210 Joint Compound" by United States Gypsum Co, or approved substitution, over entire cement board surface. All joints, fasteners, and imperfections shall be covered provide smooth level surface for final finish.

### **1.33 ADJUST AND CLEAN**

- A. Cut, patch, repair, and point-up gypsum board as required. Repair cracks and indented surfaces.
- B. Promptly remove compound from door frames, windows, and other surfaces. Repair floors, walls, and other surfaces which have been stained, marred, or otherwise damaged during the framing and gypsum board work. Daily remove unused materials, containers, and equipment. Clean floors of all gypsum board and wood debris and leave broom clean.
- C. Clean spilled or splattered materials from adjacent surfaces not to be coated, immediately before coating has achieved an initial set. Do not scratch or damage adjacent finished surfaces.

### **1.34 PROTECTION**

- A. Provide final protection and maintain conditions, in a manner suitable to installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Completion.

## **END OF SECTION**



**SECTION 09 27 13**  
**GLASS-FIBER-REINFORCED GYPSUM FABRICATIONS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Factory-Molded, Glass-Fiber-Reinforced Gypsum (GRG) Fabrications for Interior Applications.
    - a. Interior Column Covers
- B. Related Sections:
  - 1. Section 06 10 00 (06100) - Rough Carpentry.
  - 2. Section 07 92 00 (07920) - Joint Sealants
  - 3. Section 09 21 16 (09255) - Gypsum Board Assemblies.
  - 4. Section 09 51 23 (09512) - Acoustical Tile Ceilings
  - 5. Section 09 72 00 (09950) - Wall Coverings
  - 6. Section 09 90 00 (09900) - Painting.

**1.02 REFERENCES**

- A. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)
  - 1. A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"
  - 2. C11 "Standard Terminology Relating to Gypsum and Related Building Materials and Systems"
  - 3. C473 "Standard Test Methods for Physical Testing of Gypsum Panel Products"
  - 4. C475 "Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board"
  - 5. C840 "Standard Specification for Application and Finishing of Gypsum Board"
  - 6. C947 "Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading)"
  - 7. 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. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness"
  - 8. C1002 "Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs"
  - 9. C1047 "Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base"
  - 10. C1355 "Standard Specification for Glass Fiber Reinforced Gypsum Composites"
  - 11. C1381 "Standard Specification for Molded Glass Fiber Reinforced Gypsum Parts"
  - 12. C1467 "Standard Specification for the Installation of Molded Glass Fiber Reinforced Gypsum Parts"
  - 13. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"

**1.03 SYSTEM DESCRIPTION**

- A. The installing contractor shall perform all work in this section, including installation, taping and patching and will assume responsibility for coordinating installation with gypsum wallboard work and associated trades.

**1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: Submit manufacturer's detailed technical data for material and fabrication, including catalog cuts of anchors, hardware, fastenings, and related accessories.

2. Shop Drawings: Submit shop drawings for fabrication and erection of GRG components, and installation for anchorage devices. Indicate material, construction, dimensions, locations, tolerances, installation, and connection details.

#### **1.05 QUALITY ASSURANCE**

- A. Mockups: Build mockups to set quality standard for fabrication and installation.
  1. Build mockups of each type of GRG fabrication.
  2. Paint mockups to match final decoration scheduled or indicated and to comply with requirements specified in other Division 09 Sections.
  3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Fire-Test-Response Characteristics: Provide glass-reinforced gypsum (GRG) fabrications with the following surface-burning characteristics as determined by testing identical products per ASTM E84 by UL or another independent testing and inspecting agency acceptable to authorities having jurisdiction:
  1. Flame Spread: 25 or less.
  2. Smoke Developed: 450 or less.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Units shall be handled and transported per manufacturer's recommendation, in a manner so as not to create damage or excessive stresses.
- B. GRG units shall be stored level on a clean dry surface in an area protected from weather, moisture and damage. Keep material in manufacturer's original crate until ready to install. The units shall not be stacked or leaned unless instructed otherwise by the manufacturer.
  1. Do not deliver or install GRG fabrications until building is enclosed, wet work is complete, and HVAC system is operating and continuously maintaining temperature and relative humidity at levels intended for building occupants.

#### **1.07 PROJECT CONDITIONS**

- A. Environmental Conditions:
  1. Comply with requirements in ASTM C1467.
- B. Conditioning: Acclimatize GRG fabrications to ambient temperature and humidity of spaces in which they will be installed. Remove packaging and move units into installation spaces not less than 48 hours before installing them.
- C. Field Measurements: Where GRG fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

#### **1.08 COORDINATION**

- A. Coordinate layout and installation of GRG fabrications with support components specified in other Sections.

#### **1.09 PRODUCTS**

#### **1.10 MANUFACTURERS:**

- A. Avendra, LLC Preferred Manufactures:
  1. None
- B. Approved Manufacturers:
  1. DecoForm, Inc. (416-745-4970)
  2. Formglas Inc. (416-635-8030)
  3. Plastrglas, Inc. (402-455-0652)

#### **1.11 GLASS-FIBER-REINFORCED GYPSUM (GRG) FABRICATIONS**

- A. Fabrications: Molded, glass-fiber-reinforced reinforced (GRG) gypsum units complying with ASTM C1381.



1. GRG Fabricated Units: Custom Interior Column Covers;
  - a. Refer to Architectural Drawings for sizes, profiles and details.
  - b. Size: [20-inch] Diameter, smooth, plain, non-tapered profile with ½-inch deep by 4-inch high reveal base.
- B. Embedments: As standard with GRG fabrication manufacturer and as required for reinforcement and for anchorage to substrates and framing.
- C. Materials
  1. General: Provide materials selected for surface smoothness with out pitting, seam marks, stains, and other imperfections on finished units.
  2. Glass-fiber reinforced gypsum (GRG) fabrication: ASTM C1355.
  3. Gypsum: High density, free of asbestos and resins.
  4. Water: Potable.
  5. Glass-fiber: Continuous filament, random glass-fiber mat, or chopped strand fiber.
  6. Anchors and Fasteners: Type 304 stainless steel where exposed; hot dip galvanized steel where unexposed.
  7. Form stripping agent: Colorless mineral oil, free of kerosene and must be compatible with and for application of sealant and applied finishes.
  8. Units shall be suitably reinforced with additional materials as required.
- D. Design Criteria
  1. Fabrication tolerances are as indicated below.
    - a. Dimensional - all directions (0'-10'): ± 1/8" (3.2mm)
    - b. Dimensional - all directions (10'-20'): ± 3/16" (4.8mm)
    - c. Straightness along an edge or surface: ± 1/8"/linear ft.
    - d. All reveals, setbacks or returns: 5° draft
    - e. All corners: 1/16" - 1/8" radius
    - f. Surface: GRG Components shall be free of scratches and blemishes.
- E. Physical Properties

1. Glass content:	5-6% by weight.
2. Density:	103-112 lb./cu. ft.
3. Shell Thickness:	1/8" min.
4. Flame Spread Index ( <u>ASTM E84</u> ):	0
5. Fuel Contribution ( <u>ASTM E84</u> ):	0
6. Smoke Developed Index ( <u>ASTM E84</u> ):	0 (5, water vapor)
7. Compressive Strength ( <u>ASTM C472</u> ):	11,289 psi (77.83 MPa) (average)
8. Flexural Strength (M.O.R.) ( <u>ASTM C947</u> ):	3,084 psi (21.27 MPa) (mean value)
9. Flexural Strength (P.E.L.) ( <u>ASTM C947</u> ):	2,857 psi (19.70 MPa) (mean value)
10. Ultimate Tensile Strength ( <u>ASTM D638</u> ):	1,220 psi (8.41 MPa) (mean value)
11. Compressive Strength ( <u>ASTM D638</u> ):	5,790 psi (39.9 MPa) (mean value)
12. Impact Resistance ( <u>ASTM D256</u> ):	7.88 ft.lb./in. (mean value)
13. Barcol Hardness ( <u>ASTM D2583</u> ):	64 (mean value)
14. Consistency:	25-30 c.c.
15. Specific Heat:	0.253 Btu/lb./°F
16. Dielectric Strength:	Same as air w/dry, conductive w/wet
17. Coefficient of Thermal Expansion ( <u>ASTM D696</u> ):	1.31 x 10 <sup>-6</sup> mm/mm/°C (7.3 x 10 <sup>-6</sup> in/in/°F) (average)
18. Nail Pull (wood embedment) ( <u>ASTM C473</u> ):	480 lbf. (min.)
19. Nail Pull (metal embedment) ( <u>ASTM A370</u> ):	590 lbf. (min.)
20. Behaviour at 750°C ( <u>ASTM E136</u> ):	18.78% mass loss (mean average)
21. Humidified Deflection ( <u>ASTM C473</u> ):	3 mm. mid-point deflection. (mean value)

## 1.12 AUXILIARY MATERIALS

- A. Adhesives: As recommended by manufacturer.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Steel Drill Screws: Of sufficient length and size to securely fasten GRG fabrications to framing members, and as follows:
  1. Screws complying with ASTM C1002 for fastening GRG fabrications to steel members less than 0.033 inch thick.
  2. Screws complying with ASTM C954 for fastening GRG fabrications to steel members from 0.033 to 0.112 inch thick.
- C. Joint-Treatment Materials: ASTM C475.

### 1.13 FABRICATION

- A. Fabricate GRG units to comply with ASTM C1381, with smooth-finished surfaces; repair hollows, voids, scratches, and other surface imperfections. Fabricate units in lengths and sizes that will minimize number of joints between abutting units.
- B. Embedments: Incorporate embedments into units to develop the full strength of GRG fabrications. Cover embedments with not less than 3/16-inch thickness of GRG composite.
- C. Connection Hardware: Furnish units with custom shapes, brackets, and attachment hardware as designed and fabricated to support and connect GRG fabrications to hangers, support framing, and substrates.

### 1.14 EXECUTION

### 1.15 EXAMINATION

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

### 1.16 INSTALLATION

- A. Comply with requirements in ASTM C1467.
- B. Install GRG fabrications level, plumb, true, and aligned with adjacent materials. Use concealed shims where required for alignment.
- C. Attach GRG fabrications to framing and substrates with steel drill screws, unless otherwise indicated. Do not use pneumatic staple guns. Countersink screw heads below adjoining finished surface.
  1. Provide all support framing, reinforcing, and support brackets required for work of this Section and to ensure solid and secure installation.
  2. Predrill fastener holes in units. Clean fastener holes to remove dirt and oil.
  3. Locate fasteners not less than 5/16 inch from edges or ends of units.
- D. Where GRG fabrications are joined to form composite units, join fabrications with adhesive. Band or brace units together until adhesive cures.
- E. Install control joints between GRG fabrications where indicated.
- F. Use joint-treatment materials to finish GRG fabrications to produce surfaces ready to receive primers and paint finishes specified in other Division 09 Sections.
  1. Finish joints between units, other than control joints, and countersunk fastener heads to comply with ASTM C840 for Level 5 and to match surface texture of units. Exercise care in taping and finishing to prevent "crowning".
  2. Repair hollows, voids, scratches, and other surface imperfections on units.
- G. Finishing
  1. Refer to Section 09 90 00 (09900) "Painting".
  2. The painting contractor shall comply with ASTM C840 specifications, specifically with regard to sealing.

#### **1.17 ADJUSTING AND CLEANING**

- A. Repair any defects found after the work of all trades has been completed, regardless of how, or whom, the damage was caused. Patching shall match the original work.
- B. Patch all countersunk fasteners and damages to match unit's texture, finished flush with face of unit.

**END OF SECTION**

## SECTION 09 30 00

### TILING

#### GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Floor and Wall Tile and Accessories
  - 2. Crack Suppression Membrane
  - 3. Leveling Coat, Mortar, Grouts, and Adhesives
  - 4. Shower Pan Liners
  - 5. Existing Tile Restoration:
    - a. Tile Cleaning
    - b. Raking and Regrouting Joints
    - c. Sealing Grout Joints
- B. Related Sections:
  - 1. Section 03 30 00 (07920) - Cast-In-Place Concrete
  - 2. Section 07 92 00 (07920) - Joint Sealants
  - 3. Section 09 21 16 (09255) - Gypsum Board Assemblies
  - 4. Section 12 36 40 (09380) - Stone Countertops
  - 5. Section 12 36 61 (09385) - Simulated Stone Countertops
  - 6. Section 12 36 61.13 (09385) - Cultured Marble Countertops
  - 7. Section 13 11 00.01 (13151) - Swimming Pools - Exterior
  - 8. Section 13 11 00.02 (13152) - Swimming Pools - Interior
  - 9. Division 22 (15) for Plumbing Fixtures
  - 10. 10.

##### 1.02 REFERENCES

- A. Tile Council of North America, Inc. (TCNA):
  - 1. "Hand Book for Ceramic, Glass, and Stone Tile Installation", Edition or later.
- B. American National Standards Institute (ANSI)
  - 1. A108/A118/A136.1 - "American Standard Specification for the Installation of Ceramic Tile".
  - 2. A108.5 - Ceramic Tile Installed with Dry-Set Portland Cement Mortar.
  - 3. A108.6 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy
  - 4. A108.10 - Specifications for Installation of Grout in Tilework.
  - 5. A118 - Latex-Portland Cement Mortar
  - 6. A118.1 - Dry-Set Portland Cement Mortar
  - 7. A118.3 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive
  - 8. A118.4 - "Latex-Portland Cement Mortar"
  - 9. A118.7 - "Polymer Modified Cement Grouts"
  - 10. A118.12 "Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation"
  - 11. A136.1 - Organic Adhesives for Installation of Ceramic Tile
  - 12. A137.1 - Recommended Standard Specifications for Ceramic Tile
- C. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)
  - 1. C241 "Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic"
  - 2. C503 "Standard Specification for Marble Dimension Stone (Exterior)"
  - 3. C627 "Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester"
  - 4. 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"
- D. International Organization for Standards (ISO) Publications:

1. ISO 13007-1, "Ceramic tiles -- Grouts and adhesives -- Part 1: Terms, definitions and specifications for adhesives"
  2. ISO 13007-2, "Ceramic tiles -- Grouts and adhesives -- Part 2: Test methods for adhesives"
  3. ISO 13007-3, "Ceramic tiles -- Grouts and adhesives -- Part 3: Terms, definitions and specifications for grouts"
  4. ISO 13007-4, "Ceramic tiles -- Grouts and adhesives -- Part 4: Test methods for grouts"
- E. International Association of Plumbing & Mechanical Officials (IAMPO) Publications:
1. PS 106 "Prefabricated, Tileable Shower Receptors"

### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.

### 1.04 DEFINITIONS

- A. Large Format Tiles (LFT):
- B. Wet Area: Includes tile surfaces that are either soaked, saturated, or regularly and frequently subjected to moisture such as tub enclosures, showers, swimming pools, commercial kitchens and exterior areas.

### 1.05 QUALITY ASSURANCE

- A. In addition to complying with all pertinent codes and regulations, conform to ANSI A108/A118/A136.1 - "American Standard Specification for the Installation of Ceramic Tile" and ISO Classifications for Ceramic Tiles, Grouts and Adhesives.
- B.
  1. Provide surface preparation products in combination with crack isolation and waterproof, setting mortar, and grout from a single manufacturer [to provide a single source system warranty].
- C. Performance Requirements:
  1. : For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM :
    - a. All horizontal Surfaces:

### 1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use in accordance with manufacturer's directions. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- B. Comply with ANSI A137.1 for labeling sealed tile packages.
- C. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

### 1.07 PROJECT CONDITIONS

- A. Substrate shall be prepared to receive new tile in a manner acceptable to the tile manufacturer; and in accordance with ANSI Standard Installation Specification A108.1 through A108.13; and TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation".
  1. Existing flooring and other materials shall be removed and surface prepared to accept new tile.
- B. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

### 1.08 EXTRA MATERIALS

- A. Refer to Section 01 78 43 (01790)

## 1.09 PRODUCTS

### 1.10 FLOOR AND WALL TILE

- A. Approved Manufacturers:
  - 1. Ceramic Technics Ltd. (770-740-0050)
  - 2. Caesar Ceramics USA, Inc. (Ceramiche Caesar) (732-610-6967)
  - 3. Crossville, Inc. (931-484-2110)
  - 4. Dal-Tile Corporation (630-789-1479)
  - 5. Designer Tile & Stone (800-959-8453)
  - 6. Florida Tile Industries, Inc. (301-929-8453)
  - 7. Global Architectural Products, Div. of Global Granite & Marble (314-743-1081)
  - 8. GranitiFiandre (727-522-6655)
  - 9. Latco Products (800-422-6860)
  - 10. Porcelanosa USA (201-995-1310)
  - 11. Roca Tile Group (800-321-0684)
  - 12. Trans Ceramica, Ltd., A GranitiFiandre Company (888-903-4263)
- B. Floor Tile: Refer to Interior Finish Index
- C. Wall Tile: Refer to Interior Finish Index
- D. Tile Base and Accessories: Provide special shapes such as bull-nose edges and other accessories as required, to match wall tile.
  - 1. Provide matching bull-nose tile at all exposed edges.

### 1.11 CRACK SUPPRESSION MEMBRANE

- A. Approved Manufacturers:
  - 1. Sheet Membrane:
    - a. "Dal-Seal TS", Dal-Tile (800-933-Tile).
    - b. "Laticrete 170 Sound & Crack Isolation Mat"; Laticrete International Inc. (800-243-4788).
    - c. "Mapeguard 2, Crack Isolation and Sound Control"; Mapei Corp. (800-426-2734).
    - d. "ECB Green Anti-Fracture Membrane" National Applied Construction Products, Inc., (800-633-4622).
    - e. "Nobleseal CIS Crack Isolation Sheet", The Noble Co., (800-878-5788).
    - f. "TEC Hydraflex Waterproofing Crack Isolation Membrane", TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023).
- B. General: Product that complies with ANSI A118.12 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- C. Provide self-bonding elastomeric membrane capable of heavy-duty service per ASTM C627. Liquid-applied products will not be allowed.
- D. Primer: As required by the membrane manufacturer.
- E. Furnish in 12 inch and 36 inch wide sheets in lengths required.

### 1.12 LEVELING COAT

- A. Concrete Leveling and Patching Compounds:
  - 1. Verify with manufacturer of the setting materials that the product utilized is compatible with their products.
  - 2. For areas up to 4 square feet:
    - a. Feather finish, use to smooth ridges, fill cracks, gouges and joints.
      - 1) "SD-F"; Ardex (724-203-5000)
      - 2) "Planiprep FF"; Mapei Corp. (800-426-2734)
      - 3) "Versa Patch"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
      - 4) "NXT Level Plus with NXT Primer"; Laticrete International Inc. (800-243-4788)

- b. Trowelable underlayment patch for thickness from feather edge to 3 inch without aggregate
      - 1) "Quickpatch"; Mapei Corp. (800-426-2734)
      - 2) "Fast Set Deep Patch"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
      - 3) "NXT Level Plus with NXT Primer"; Laticrete International Inc. (800-243-4788)
    - c. Trowelable underlayment patch for thickness up to ½ inch without aggregate; up to 1 inch with aggregate. Can be feather edged.
      - 1) "SD-P/ Primer P-82"; Ardex (724-203-5000)
  - 3. For areas exceeding 4 square feet:
  - 4. Self-leveling, pourable or pumpable underlayment for thicknesses up to 5 inches. Can be feather edged. Must be installed a minimum of 1/4 inch.
    - a. "K-15/Primer P-51"; Ardex (724-203-5000)
    - b. "Novoplan 2/Primer"; Mapei Corp. (800-426-2734) (Note: Refer to product datasheet for specific requirements based on substrates).
    - c. "EZ Level TA-323/Multi Purpose Primer"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
    - d. "NXT Level with NXT Primer"; Laticrete International Inc. (800-243-4788)
- B. Maximum variation in surface of leveling coat shall not exceed 1/8" in 8'-0" from required plane.
- C. Leveling coat shall be cured at least 24 hours before tile is applied.
- D. Surface to which leveling coat is to be applied shall be free of any coatings, oil, and wax.

#### **1.13 MORTAR MATERIALS: FLOOR TILE**

- A. Approved Manufacturers:
  - 1. Laticrete International Inc. (800-243-4788)
  - 2. Mapei Corp. (800-426-2734)
  - 3. Bonsal America, Inc., A division of Oldcastle APG (800-738-1621)
  - 4. Custom Building Products (800-272-8786)
  - 5. Hydroment (Bostick Findley, Inc.) (800-523-2678)
  - 6. TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
  - 7. Ardex (724-203-5000)
- B. Acceptable Products: Refer to Setting and Grout Material Schedule at end of this Section.
- C. Bond Coat: Thin Set Mortar with Polymer or Acrylic/Latex Additive

#### **1.14 WALL ADHESIVE MATERIALS - CERAMIC TILE - MASTIC TYPE**

- A. High strength latex-based, non-flammable adhesive formulated to meet or exceed the requirements of ANSI A136.1, Type 1 and ISO 13007 D2TE.
- B. Gypsum Wallboard:
  - 1. Approved Manufacturers:
    - a. Laticrete International Inc. (800-243-4788)
    - b. Mapei Corp. (800-426-2734)
    - c. Bonsal America, Inc., A division of Oldcastle APG (800-738-1621)
    - d. Custom Building Products (800-272-8786)
    - e. Hydroment (Bostick Findley, Inc.) (800-523-2678)
    - f. TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
    - g. Ardex (724-203-5000)

#### **1.15 GROUT MATERIALS**

- A. Latex Portland Cement Grout consisting of mortar with an acrylic latex or polymer epoxy additive. Use in conformance with ANSI A108.5 and ANSI A108.10. Materials shall conform to ANSI A118.3 and ANSI A118.7.
  - 1. Color as shown on Interior Finish Index.
- B. Approved Manufacturers:

1. Laticrete International Inc. (800-243-4788)
    - a. Epoxy Grout (All Joint Widths - Floor and Wall)
      - 1) All areas except Swimming Pool Decks and Prep-Kitchens: "SpectraLOCK Pro Epoxy Grout"
      - 2) Swimming Pool Decks and Prep-Kitchens: "SpectraLOCK 2000 IG"
  2. Mapei Corp. (800-426-2734)
    - a. Epoxy Grout (All Joint Widths - Floor and Wall)
      - 1) All areas except Swimming Pool Decks and Prep-Kitchens:
- C. Approved Manufacturers:
1. Laticrete International Inc. (800-243-4788)
    - a. All joints 1/8" or greater:
      - 1) "Permacolor Grout"
    - b. All joints widths less than 1/8":
      - 1) "Permacolor Grout"
  2. Mapei Corp. (800-426-2734)
    - a. All joints 1/8" or greater:
      - 1) "Ultracolor Plus" (Sanded)
    - b. All joints widths less than 1/8":
      - 1) (unsanded)
    - c. c.
      - 1) 1)
    - d. Epoxy Grout (All Joint Widths - Floor Only)
      - 1) "Kerapoxy IEG" Epoxy Grout
  3. Custom Building Products (800-272-8786)
    - a. All joints 1/8" or greater:
      - 1) "Polyblend Sanded Tile Grout" (sanded)"
    - b. All joints widths less than 1/8":
      - 1) "Polyblend Non-Sanded Tile Grout" (unsanded)
    - c. Epoxy Grout (All Joint Widths - Floor Only)
      - 1) "100% Solids Epoxy Grout"
  4. Hydroment (Bostick findley, Inc.) (800-523-2678)
    - a. All joints 1/8" or greater:
      - 1) "Ceramic Tile Grout / #425 Multi Purpose Acrylic Latex Additive" (sanded)
    - b. All joints widths less than 1/8":
      - 1) "Dry Tile Grout / #425 Multi Purpose Acrylic Latex Additive" (unsanded)
    - c. Epoxy Grout (All Joint Widths - Floor Only)
      - 1) "Hydroment Color-Poxy"
  5. TEC Specialty Construction Brands (800-832-9023)
    - a. All joints 1/8" or greater:
      - 1) "TEC Accucolor Sanded Grout / 869 Latex Additive"
    - b. All joints widths less than 1/8":
      - 1) "TEC Accucolor Unsanded Grout / 869 Latex Additive"
    - c. Epoxy Grout (Joints 1/16"-1/2" - Floor Only)
      - 1) "TA470 Epoxy Grout and Mortar"

#### **1.16 SHOWER FLOOR PAN LINER WATERPROOF MEMBRANE**

- A. Waterproof Membrane Material for lining concrete subfloor of tile showers that comply with ANSI 118.10, in locations shown on Drawings shall be one of the following products:
1. Approved Manufacturers:
    - a. "Laticrete HydroBan"; Laticrete International Inc. (800-243-4788)
    - b. "Mapelastic AquaDefense"; Mapei Corp. (800-426-2734)
    - c. "Chloraloy"; The Noble Co. (800-878-5788)
    - d. "DITRA"; Schluter Systems L.P. (800-472-4588)



- e. "TEC Hydraflex Waterproofing Crack Isolation Membrane", TEC Specialty Construction Brands (800-832-9023).
  - f. "Bituthene 3100"; W.R. Grace Masonry Products (800-558-7006)
- B. Provide all required accessories including preformed inside and outside corners, cap strips, and pipe protrusion collars.

#### **1.17 PREFABRICATED SHOWER FLOOR PAN**

- A. Prefabricated Shower Pan and Curb system for use in locations shown on Drawings shall be one of the following products:
- 1. Approved Manufacturers:
    - a. "Tile Ready"; Tile-Redi USA LLC (800-232-6156)
    - b. "HydroBan Shower System"; Laticrete International Inc. (800-243-4788)
- B. Materials:
- 1. "Tile Redi "Tile Ready" System:
    - a. Prefabricated shower pan and curb system with fully integrated drains shall be one-piece molded polyurethane receptor listed by UL as plastic plumbing fixtures, and in conformance with ASTM F462. Where installed in Accessible Roll-In Showers, conform to ANSI A117.1 and all local codes.
      - 1) Size: and configuration as shown on Drawings.
      - 2) Provide all required accessories including epoxy setting materials. Provide "Redi Flash" flashing material to waterproof junctions between shower pan and wall board. All as recommended by shower pan manufacturer.
  - 2. Laticrete "HydroBan Shower System":
    - a. Prefabricated and pre-sloped shower pan and curb system with fully integrated drains shall be one-piece lightweight high-density expanded polystyrene pan, and in conformance with IAMPO PS 106 and ANSI A118.10. Where installed in Accessible Roll-In Showers, conform to ANSI A117.1 and all local codes.
      - 1) Size: and configuration as shown on Drawings.
      - 2) Provide all required accessories including Laticrete "HydroBan" Adhesive and Sealant materials. To install curb and to waterproof junctions between shower pan and wall board. All as recommended by shower pan manufacturer.

#### **1.18 THRESHOLDS**

- A. Refer to Section [12 36 40 "Stone Countertops"] [12 36 61 "Simulated Stone Countertops"].

#### **1.19 ACCESSORIES**

- A. Edging and Transition Strips for floor tile:
- 1. Approved Manufacturers:
    - a. Schluter Systems (800-574-8481)
    - b. Ceramic Tool Company, Inc. (800-236-5230)
  - 2. Miter corners and angles. Install in longest lengths possible with closely fitted and aligned butt joints, and with horizontal leg keyed into the mortar bed. Top edge shall be set flush with finished floor tile. Clean and remove any mortar stains.

#### **1.20 OTHER MATERIALS:**

- A. Joint Sealant to include sealing of ceramic tile surfaces at internal and external corners, transitions in plane and where ceramic tile work abuts dissimilar materials.
- 1. Refer to Section 07920 (07 92 00) for sealant specifications.
- B. Other materials, including adhesives not specifically described but required for a complete and proper installation of tiles, shall be only as recommended by the manufacturer of material to which it is applied.

#### **1.21 MIXING MORTARS AND GROUT**

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## **1.22 EXECUTION**

### **1.23 INSPECTION:**

- A. Installer must examine the areas and conditions under which flooring and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

### **1.24 PREPARATION:**

- A. Prior to laying flooring, vacuum and remove all contaminants from surfaces to be covered and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.
  - 1. Concrete Subfloors:
    - a. Slab substrates are dry and free of curing compounds, sealers, hardeners, residual adhesives, adhesive removers, and other materials whose presence would interfere with bonding of tile adhesive or mortar and comply with surface finish requirements of ANSI A108.01. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer.
    - b. Subfloor Moisture Conditions: Before installing flooring Contractor shall verify that Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1 and does not exceed the capacity of the specified adhesive or mortar, with subfloor temperatures not less than 55 deg F, or as recommended by manufacturer.
    - c. New concrete surfaces shall be wood-floated or broom finished. Overtroweled slabs are not acceptable.
    - d. Existing concrete slabs shall be mechanically prepared to a minimum IRCI CSP #3 profile, or as recommended by setting mortar manufacturer.
  - B. For installations of Tiles 24" x 24", 18" x 38" or larger:
    - 1. Interior Floors: This Contractor shall use cement based, self leveling underlayment to insure flat substrate to receive tile, full mortar coverage of tile and substrate, and tile installation free of lippage.
    - 2. Interior Walls: This Contractor shall use cement based trowelable patch to remedy all wall surfaces to receive large unit tile. Install tile with minimum 95% mortar coverage to tile & substrate. Tile installation shall be free of lippage.
- C. Apply concrete slab primer for ceramic tile, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

### **1.25 CRACK SUPPRESSION MEMBRANE**

- A. Install membrane in strict accordance with manufacturer's specifications and ANSI A108.17.
- B. Provide width of membrane as recommended by membrane manufacturer, but no less than three (3) times the width of the tile used at all control joints, existing cracks in concrete floor and other locations as required to comply with TCNA's "Handbook for Ceramic Tile Installation".

### **1.26 TILE INSTALLATION - GENERAL**

- A. Comply with the ANSI A108 and TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation".
- B. Handle, store, mix, and apply mortar and grout in compliance with manufacturer's instructions.

- C. Extend tile work into recesses and under equipment and fixtures to form a complete covering without interruptions. Terminate work neatly at obstructions, edges, and corners without disruption of pattern, joint alignment, or bridging of Expansion Joints or Control Joints.
- D. Install tile after finishing operations, including painting, have been completed. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by the flooring manufacturer.
- E. Expansion Joints: Provide expansion joints, control joints and pressure relieving joints of widths and locations according to TCNA Handbook Construction No. EJ171, and as approved by [Owner's Representative] [Architect]. Do not saw cut joints after application.
- F. Lay tile from center marks established from center of area so that tile at opposing edges of the area are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at edge perimeters. Lay tile square to room axis unless otherwise shown.
- G. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly in and around all fixtures. Broken, cracked, chipped, or deformed tile are not acceptable.
- H. Lay tile with grain in tile running in same direction. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items.
- I. Sound tile after setting and replace hollow sounding units.
- J. Grout tile to comply with the requirements of the ANSI A18.10 tile installation standards:

#### **1.27 SHOWER FLOOR PAN LINER WATERPROOF MEMBRANE INSTALLATION**

- A. Install materials to comply with and ANSI A108.13 and as directed by manufacturer to provide a concealed waterproof membrane. All seams shall be adhered to prevent delamination as specified by manufacturer. Upon completion, test for leaks by plugging the drain and filling with water. Make necessary adjustments to stop all leakage and retest until watertight, before top layers are installed.
  - 1. Do not install tile or setting materials over waterproof membrane until waterproofing has cured and been tested to determine that it is watertight.

#### **1.28 PREFABRICATED SHOWER FLOOR PAN INSTALLATION**

- A. Install materials as directed by manufacturer to provide a concealed waterproof system. Upon completion, test for leaks by plugging the drain and filling with water. Make necessary adjustments to stop all leakage and retest until watertight, before finish materials are installed.

#### **1.29 FLOOR TILE INSTALLATION**

- A. General: Install tiles designated for floor installations in accordance with TCNA's "Handbook for Ceramic Tile Installation,
- B. Back Buttering: For installations indicated, obtain 100% mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
  - 1. Exterior tile floors.
  - 2. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
  - 3. Tile floors composed of tiles 8"x 8" or larger.
  - 4. Tile floors composed of rib-backed tiles.
  - 5. Thin porcelain veneer tile floors composed of tile less than 8mm in thickness.
  - 6. All Tiles larger than 16" x 16", or with at least one edge 24" or greater.
- C. Large Format Tiles (LFT) shall be installed in a medium bed of setting material.
- D. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
- E. Metal Edge Strips: Install at locations indicated or at all locations where exposed edge of tile flooring meets carpet, wood, or other flooring, unless otherwise indicated.

### 1.30 WALL TILE INSTALLATION

- A. General: Install tiles designated for wall installations in accordance with TCNA's "Handbook for Ceramic Tile Installation,
- B. Back Buttering: For installations indicated, obtain 100% mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
  - 1. Exterior tile wall installations.
  - 2. Tile wall installations in wet areas, including showers, tub enclosures, laundries, and swimming pools.
  - 3. Tile wall installations composed of tiles 8"x 8" or larger.
  - 4. Thin porcelain veneer tile walls composed of tile less than 8mm in thickness.

### 1.31 GROUTING

- A. Joints shall be packed full and free of all voids or pits, joints shall not be raked. Excess grout shall be cleaned from the surface with water as work progresses. Cleaning shall be done while mortar is fresh and before it hardens on the surface.
- B. Grout shall be installed in accordance with ANSI A108.10 (A108.6 for epoxy) and the manufacturer's recommended procedures and precautions during application and cleaning.
  - 1. Tile shall be grouted using latex Portland cement grout unless noted otherwise.
  - 2. Tile in kitchen and associated adjacent areas shall be grouted using chemical resistant epoxy grout.
- C. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

### 1.32 EXISTING TILE RESTORATION

- A. Cleaning Of Existing Tile:
  - 1. Apply cleaner and let stand for 5 minutes.
  - 2. Scrub with soft bristle brush to loosen and remove soap scum and other deposits.
  - 3. Rinse with water until all traces of cleaner has been removed from tile surface.
- B. Field-Constructed Mockups: Prior to starting floor cleaning, prepare mockup on existing floors. Prepare mockups using same materials and methods proposed for the Work. Obtain Owners Representative's acceptance of visual qualities before proceeding with remainder of cleaning. Retain mockup area in an undisturbed condition, suitably marked, during cleaning as a standard for judging the completed Work.
  - 1. Marble Floor Cleaning: Demonstrate the materials and methods to be used for cleaning each type of surface and condition on sample location approximately 16 sq. ft. in area. Test area shall be allowed to dry per manufacturer's recommendations before review.
  - 2. Notify Owner's Representative one week in advance of dates and times when samples will be prepared.
- C. Grout Removal:
  - 1. Using grout saw or other suitable grout removal tool, remove existing grout from all joints to minimum depth of 1/4" below face of tile.
  - 2. Take all precautions necessary to prevent damage to tile.
  - 3. Do not use chemical agents to remove grout.
  - 4. Vacuum entire surface to remove loose grout particles and debris.
- D. Sealing Tile Floors
  - 1. Before tile is grouted apply sealer following manufacturers printed instructions.
  - 2. Apply evenly over tile using a clean soft cotton cloth or a lambs wool applicator; buff off surface and allow to cure.
  - 3. After tile has been grouted and cleaned, apply a second coat of sealer to tile and grout joints.
- E. Regrouting:

1. Mix dry ingredients with admixture first and in accordance with manufacturer's recommendations.
    - a. Do not add water, additional grout or other ingredients after slaking period.
    - b. Color as shown on Interior Finish Index.
  2. Do not grout joint between side of bathtub and tile. Seal with sanitary sealant.
  3. Install grout in accordance with ANSI A108.10. Use rubber float, firmly pull grout diagonally across joints to force grout into and uniformly fill all joints.
  4. Fill all gaps and skips. Finished grout shall be uniform in color, smooth and without voids, pin holes or low spots.
  5. Remove excess grout from face of tile using sponges and clean water. Change water frequently.
- F. Final Cleaning:
1. After grout has set, thoroughly rinse tile surfaces with sponges and clean water to remove any remaining grout film from face of tile.
  2. Immediately following rinse, remove all water with wet/dry vacuum or clean sponge.
  3. Clean tile to remove all grout haze and residue. Utilize specified cleaning products to leave floor thoroughly cleaned as approved by Owner's Representative.
  4. At floors, apply coat of sealer to tile and grout joints.

### 1.33 ADJUST AND CLEAN

- A. Clean grout and setting material from face of tile while materials are workable. Leave tile face clean and free of all foreign matter.
- B. Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective work.
- C. Protection: When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed surface. Protect installed tile work with Kraft paper or other heavy covering during the construction period to prevent damage. Prohibit all foot and wheel traffic from using tiled floors for at least 3 days, preferably 7 days.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from all tile surfaces.

### 1.34 SETTING AND GROUT MATERIAL SCHEDULE

	TILE (< 8" X 8")	LARGE FORMAT TILE (≥ 8" X 8")	INDOOR POOL/SPA (< 8" X 8")	PREP KITCHEN (< 8" X 8")
<b>A. <u>LATICRETE INTERNATIONAL</u></b>				
<b>MORTAR - FLOOR</b>	"LATICRETE 254 PLATINUM MULTIPURPOSE THINSET MORTAR"	"LATICRETE 255 MULTIMAX MULTIPURPOSE THINSET MORTAR" OR "LATICRETE 4XLT THINSET (REGULAR OR RAPID)"	"LATICRETE 254 PLATINUM MULTIPURPOSE THINSET MORTAR"	"LATICRETE 254 PLATINUM MULTIPURPOSE THINSET MORTAR"

	ADHESIVE – GYPSUM WALL BOARD	“LATICRETE 15 PREMIUM MULTI-MASTI C ADHESIVE”	“LATICRETE 255 MULTIMAX MULTIPURPO SE THINSET MORTAR” OR “LATICRETE 4XLT THINSET (REGULAR OR RAPID)”	“LATICRETE 254 PLATINUM MULTIPURPO SE THINSET MORTAR”	“LATICRETE 254 PLATINUM MULTIPURPO SE THINSET MORTAR”
		“SPECTRA LOCK PRO EPOXY GROUT”	“SPECTRA LOCK PRO EPOXY GROUT”	“SPECTRA LOCK 2000 IG”	“SPECTRA LOCK 2000 IG”
<b>B.</b>	<b><u>MAPEI CORP.</u></b>				
	MORTAR – FLOOR- INTERIOR APPLICATION	“ULTRAFLEX 3”	“ULTRAFLEX LFT”		
	ADHESIVE – GYPSUM WALL BOARD	“TYPE 1 MASTIC’	“ULTRAFLEX LFT”		
	GROUT				
<b>C.</b>	<b><u>BONSAL AMERICA</u></b>				
	MORTAR - FLOOR	“PRO SPEC PERMAFLEX 400”			
	ADHESIVE – GYPSUM WALL BOARD	“PRO SPEC B-4050 MULTI-PURP OSE ADHESIVE”			
	GROUT	SEE NOTE 1	SEE NOTE 1		
<b>D.</b>	<b><u>HYDROMENT</u></b>				
	MORTAR - FLOOR	“HYDROMEN T FLEX-A-LAST IC/TILE-MATE ”			
	ADHESIVE – GYPSUM WALL BOARD	“HYDROMEN T D2001”			
	GROUT	SEE NOTE 1	SEE NOTE 1		
<b>E.</b>	<b><u>CUSTOM BUILDING PROD</u></b>				

	<b>MORTAR - FLOOR</b>	<b>"FLEXBOND PREMIUM FLEXIBLE BONDING MORTAR"</b>			
	<b>ADHESIVE – GYPSUM WALL BOARD</b>	<b>"ACRYLPRO CERAMIC TILE ADHESIVE"</b>			
	<b>GROUT</b>	<b>SEE NOTE 1</b>	<b>SEE NOTE 1</b>		
<b>F.</b>	<b><u>TEC</u></b>				
	<b>MORTAR - FLOOR</b>	<b>"TEC SUPERFLEX THINSET MORTAR"</b>	<b>"TEC ULTIMATE LARGE TILE MORTAR"</b>	<b>"TEC SUPERFLEX THINSET MORTAR"</b>	<b>"TEC SUPERFLEX THINSET MORTAR"</b>
	<b>ADHESIVE – GYPSUM WALL BOARD</b>	<b>"TEC DOUBLE DUTY PLUS"</b>	<b>"TEC 3N1 PERFORMAN CE MORTAR"</b>		
	<b>GROUT</b>	<b>SEE NOTE 1</b>	<b>SEE NOTE 1</b>		
<b>G.</b>	<b><u>ARDEX</u></b>				
	<b>MORTAR - FLOOR</b>	<b>"ARDEX X-5"</b>	<b>"ARDEX X-5"</b>	<b>"ARDEX X-5"</b>	<b>"ARDEX X-5"</b>
	<b>ADHESIVE – GYPSUM WALL BOARD</b>	<b>"ARDEX D14 TYPE I PREMIXED TILE ADHESIVE (MASTIC)"</b>	<b>"ARDEX X 5 FLEXIBLE THINSET MORTAR"</b>	<b>"ARDEX X 5 FLEXIBLE THINSET MORTAR"</b>	<b>"ARDEX X 5 FLEXIBLE THINSET MORTAR"</b>

<b>GROUT</b>	<b>SEE NOTE 1</b>	<b>SEE NOTE 1</b>		

**END OF SECTION**

**SECTION 09 51 23**  
**ACOUSTICAL TILE CEILINGS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Suspended Metal Grid Systems Complete With Wall Trim
  - 2. Suspended Fiberglass Grid Systems Complete With Wall Trim
  - 3. Ceiling Tiles
- B. Related Sections:
  - 1. Divisions 21 (13), 23 (15), and 26 (13) Sections for light fixtures, sprinklers, and air-distribution components.

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
  - 2. C635 "Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings"
  - 3. C636 "Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels"
  - 4. E1264 "Standard Classification for Acoustical Ceiling Products"
- B. United States Department of Agriculture Food Safety and Inspection Service (USDA FSIS) Requirements

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Manufacturer's product and maintenance data for each type of ceiling system and accessory.
  - 2. Samples: Min 6" x 6" samples of specified acoustical panel, 8" long samples of exposed wall molding, trim and suspension system (main runner and cross-tee).
    - a. Complete the LEED Materials Submittal Form as provided in Section 01 33 00 "Submittal and Substitution Procedures, for products in this Section.

**1.04 QUALITY ASSURANCE**

- A. Qualifications of Installers:
  - 1. The suspended ceiling Subcontractor shall have a record of successful installations of similar ceilings acceptable to the Architect.
  - 2. For the actual fabrication and installation of all components of the system, use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.
- B. In addition to complying with all pertinent codes and regulations, suspension system shall be installed according to ASTM C636, Installation of Metal Ceiling Suspension System for Acoustical Tile and Lay-in Panels.
- C. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect work and materials of all other trades.



## 1.06 PROJECT CONDITIONS

- A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust-generating activities have terminated, and overhead work is completed, tested, and approved.

## 1.07 REPLACEMENT STOCK

- A. Refer to Section 01 78 43 (01790).

## 1.08 PRODUCTS

## 1.09 STRUCTURAL EXPOSED SUSPENSION SYSTEM

- A. Preferred Manufacturers:
  - 1. Armstrong World Industries, Inc. (888-234-5464)
- B. Approved Manufacturers:
  - 1. System used shall be as shown in Interior Finish Index or approved substitution by:
    - a. Chicago Metallic Corp. (800-323-7164)
    - b. USG Interiors, Inc. (800-950-3839)
- C. Type I Grid:
  - 1. Acceptable Products:
    - a. "DX-24 Grid System"; USG Interiors, Inc.
    - b. "Prelude XL 15/16" Exposed Tee System"; Armstrong World Industries, Inc.
    - c. "200 Snap-Grid System"; Chicago Metallic Corp.
    - d. Armstrong World Industries, Inc.
  - 2. System used shall be double web, direct hung exposed system.
    - a. General: The systems shall be such that the ceiling panels may be removed without damage; that the main runner and cross runners may be removed and replaced without deforming the runners or disturbing the balance of the grid system.
  - 3. Main Runners
    - a. Acceptable Products:
      - 1) "7300 Series" with 1-1/2" ht., 15/16" face, steel; Armstrong World Industries, Inc.
      - 2) "Number DX-24" with 1-1/2" ht., 15/16" face, steel; USG Interiors, Inc.
      - 3) "Number 211" with 1-1/2" ht., 15/16" face, steel; Chicago Metallic Corp.
    - b. The main runner shall have a non-directional bayonet coupling.
  - 4. Cross Runners: Designed to support lay-in lighting fixtures and to receive acoustical tile at sides of fixture opening.
    - a. Acceptable Products:
      - 1) "Number XL-7328/7348 Cross Tee"; Armstrong World Industries, Inc.
      - 2) "DX-216/416 Cross Tee"; USG Interiors, Inc.
      - 3) "Number 226/209 Cross Tee"; Chicago Metallic Corp.
  - 5. Perimeter Wall Angles: Hemmed edge, 7/8" x 7/8".
  - 6. Accessories: Provide all accessories needed for proper installation of system.
  - 7. Finish: All exposed surfaces shall be finished white.
- D. Type 2 Grid:
  - 1. Acceptable Products:
    - a. "Fineline DXF Grid System"; USG Interiors, Inc.
    - b. "Supra-Fine XL 7500 Series Grid System"; Armstrong World Industries, Inc.
    - c. "Ultraline 3500 Grid System"; Chicago Metallic Corp.
    - d. Armstrong World Industries, Inc.
  - 2. System used shall be double web, direct hung exposed system, aluminum tee with painted aluminum cap.
    - a. General: The systems shall be such that the ceiling panels may be removed without damage; that the main runner and cross runners may be removed and replaced without deforming the runners or disturbing the balance of the grid system.
  - 3. Main Runners:

- a. Acceptable Products:
  - 1) "7500 Series" with 1-1/2" ht., 9/16" face, steel; Armstrong World Industries, Inc.
  - 2) "DXF Main Tee" with 1-25/32" ht., 9/16" face, steel; USG Interiors, Inc.
  - 3) "3500 Series" with 1-5/8" ht., 9/16" face, steel; Chicago Metallic Corp.
- b. The main runner shall have a non-directional bayonet coupling.
- 4. Cross Runners: Designed to support lay-in lighting fixtures and to receive acoustical tile at sides of fixture opening. Provide light fixture accessory as required to support specified light fixtures.
  - a. Acceptable Products:
    - 1) "Number XL-7520"; Armstrong World Industries, Inc.
    - 2) "DXF Cross Tee"; USG Interiors, Inc.
    - 3) "3512 Series Cross Tee"; Chicago Metallic Corp.
- 5. Perimeter Wall Angles: [Hemmed edge, 9/16" x 15/16"] [, or] [, and] [Shadow Molding] [in locations as shown on the Drawings].
- 6. Accessories: Provide all accessories needed for proper installation of system.
- 7. Finish: All exposed surfaces shall be finished white, unless scheduled otherwise.

#### 1.10 FIBERGLASS CEILING GRID SYSTEM

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Sanigrid II Fiberglass Ceiling Grid System (SAN)"; Crane Composites, Inc. (800-435-0080)
- C. Materials:
  - 1. Performance: Provide fiberglass ceiling grid system with the following:
    - a. Meets Class A finish requirements: Flamespread of less than 25, smoke developed less than 450 per ASTM E84 latest version.
    - b. Complies with USDA FSIS requirements.
  - 2. Components:
    - a. Wall Angles: 12 foot length fastened directly to the wall with "Kemlite" nylon drive rivets or stainless steel screws.
    - b. Hanger Wire: Provided by others, manufacturer's standard; secured with stainless steel anchors.
    - c. Main runners: 12'-0-1/2", notched on 24-1/4 inch centers.
    - d. Cross Tee: 48 1/2" and 24 1/2" lengths, pre-notched ends.
    - e. Connector clip: Joins main runners.
    - f. Wall Anchor: "Part #C-20" to secure main and cross tees to wall angle.
  - 3. Color: As shown on Interior Finish Index.

#### 1.11 CUSTOM PERIMETER TRIM

- A. Manufacturer:
  - 1. Preferred Manufacturers:
    - a. "Axiom-Classic Custom Perimeter Trim"; Armstrong World Industries, Inc. (888-234-5464)
  - 2. Approved Manufacturers:
    - a. Approved Substitution
- B. Components: Edge trim system for suspended ceiling system, extruded aluminum alloy 6063 trim channel, 10 foot curved profiles outside radii for acoustical and for drywall applications.
  - 1. Trim Channel: Provide face width as shown on Drawings with 3/4 inch horizontal legs, curved sections with special bosses formed for attachment to the Axiom tee-bar connection clip or hanging clip; commercial quality, extruded aluminum, factory-finished in factory-applied baked polyester paint to match color of ceiling tile or gypsum board paint as shown on Interior Finish Index.
  - 2. Accessories:

- a. Hanging clip, commercial quality aluminum, unfinished, used when suspension wires must be attached directly to the trim sections.
- b. Splice with set screws, galvanized steel, unfinished, used to attach joints between sections of trim.
- c. T-bar Connector Clip, galvanized steel, unfinished, used to attach channel trim to supporting suspension members.
- d. Perimeter Trim Hold Down Clip used to secure cut edges of metal panels at the Axiom trim.
- e. Drywall Bottom Trim Curved, extruded aluminum, 120 inches x 1-9/64 inch x 27/32 inch, used to finish edges of 5/8 inch drywall that is applied to the bottom surface of the Axiom.

#### **1.12 ACOUSTICAL MATERIALS**

- A. Product: Refer to Interior Finish Index.

#### **1.13 LIGHTING: CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SUFFICIENT SUPPORT ON GRID SYSTEMS TO SUPPORT LIGHT FIXTURES. ALL FIXTURES SHALL BE SUPPORTED AT EACH AND EVERY CORNER.**

#### **1.14 EXECUTION**

#### **1.15 SURFACE CONDITIONS**

- A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that suspended ceiling systems are installed in strict accordance with all pertinent codes and regulations, and the manufacturer's recommendations.
- B. Discrepancies: In the event of discrepancy, immediately notify the Owner's Representative. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

#### **1.16 INSTALLATION**

- A. General:
  - 1. Install acoustical panel, suspension system and accessories in compliance with manufacturers instructions and requirements of ASTM C636.
  - 2. Install ceiling system in a true and even plane with straight line courses laid out symmetrically about center lines of area or as indicated. Border tile shall be minimum 6" wide and neatly fit against vertical surfaces to form a tight fit.
  - 3. Provide metal edge angle at perimeter of units as detailed on Drawings. Cut and fit around light fixtures, diffusers, etc.
- B. Lay-In Ceiling System:
  - 1. Hanging main tees parallel in a flat plane by means of #10 gauge wire hangers attached to construction above. Hangers shall be spaced not over 4'-0" along the main tees and within 6" of the ends and splices of main tees, and other interruptions. Main tees shall be spaced 2'- 0" o.c. Cross tees shall be interlocked to main tees and spaced as required to support tile edges.
  - 2. Attachment to ducts, pipes, etc. will not be permitted. Bridge under obstructions with a grid of 1-1/2" cold rolled channels or other suitable members to support ceiling grid.
  - 3. Install wall angle at perimeter of walls, partitions, columns, pipes, and other obstructions that extend above the ceiling. Securely attach with appropriate fastening devices at maximum 16" o.c. Form reveal of same depth and width as that formed between edge of panel and flange at exposed suspension grid. Neatly cut and fit around light fixtures, diffusers, etc. Provide wall angles fabricated to diameter required to fit penetrations.
  - 4. Insert ceiling panels, installing hold down clips on panels extending over partitions and where required to maintain fire ratings.
  - 5. At all locations where ceiling tiles are cut, the cut edges of the tiles shall match the premanufactured edges (i.e. cut edges are to be beveled to match beveled edged tiles). Exposed cut edges are to be painted to match face of tile with paint as approved by tile manufacturer.

#### **1.17 ADJUSTING AND CLEANING**

- A. Completely remove all finger prints and traces of soil and damage from the surfaces of grid and acoustical materials, using only those cleaning materials recommended for that purpose by the manufacturer of the material being cleaned.
- B. Replace units which are damaged or improperly installed.

**END OF SECTION**

**SECTION 09 65 00**  
**RESILIENT FLOORING**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Vinyl Composition Tile
  - 2. Vinyl Plank Flooring Tile
    - a. Cushion Underlayment
    - b. Sheet Vinyl Flooring
      - 1) Woven Vinyl Sheet Flooring
      - (a) Cushion Underlayment
    - c. Resilient Base
    - d. PVC Thresholds
    - e. Solid Vinyl Transition Edges
    - f. Stair Nosings
  - 3. Related Sections:
    - a. Section 09 30 00 (09310) - Tiling
    - b. Section 09 68 00 (09680) - Carpeting
    - c. Section 14 24 23 (14240) - Hydraulic Elevators

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. C241 "Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic"
  - 2. C503 "Standard Specification for Marble Dimension Stone (Exterior)"
  - 3. D2047 "Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine"
  - 4. D2240 "Standard Test Method for Rubber Property-Durometer Hardness"
  - 5. D3389 "Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform, Double-Head Abrader)"
  - 6. E648/NFPA 253 "Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source"
  - 7. E662/NFPA 258 "Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials"
  - 8. F710 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring"
  - 9. F1066 "Standard Specification for Vinyl Composition Floor Tile"
- B. Carpet & Rug Institute (CRI)
  - 1. Standard for Installation of Commercial Carpet CRI 104, Current Edition
- C. Code of Federal Regulations (CFR)
  - 1. 40 CFR 763 - Asbestos: Appendix A - Transmission Electron Microscopy Analytical Methods
  - 2. Occupational Safety & Health Administration (OSHA) Regulations:
    - a. OSHA Regulation 29 CFR Toxic and Hazardous Substances 1910-1200 Hazard Communication

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit manufacturer's product and maintenance data for each type of resilient flooring and accessory.

- a. Certification by resilient flooring manufacturer that products supplied for flooring installation comply with local regulations controlling use of volatile organic compounds (VOCS).
  - b. Asbestos Content: Provide written certification that tile and adhesive materials contain no asbestos of any type of mixture of types occurring naturally as impurities as determined by polarized light microscopy test per Appendix A of 40 CFR 763 will be utilized on this Project.
  - c. Submit color selection in the form of actual sections of resilient flooring, including accessories, for each type of resilient flooring required showing full range of colors and patterns available.
  - d. Submit shop drawings, seaming plan, and coving details for flooring and accessories.
2. Installer Certificates: Signed by sheet vinyl flooring system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install sheet vinyl flooring system.

#### **1.04 QUALITY ASSURANCE**

- A. Single-Source Responsibility for Flooring: Obtain each type, color and pattern of flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.
- B. Installer: A firm with not less than five years of successful experience in installation of sheet vinyl flooring systems with chemically welded seams similar to those required for this project and which is certified by manufacturer of the sheet vinyl materials.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
  1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E648.
  2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E662.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver tiles and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 65 degrees F. and 90 degrees F. Store tile flooring materials on flat surfaces. Move resilient flooring and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.
- C. Store sheet vinyl rolls upright. Move sheet vinyl floor coverings 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 manufacturer.

#### **1.06 PROJECT CONDITIONS**

- A. Maintain a minimum temperature of 70 degrees F. in spaces to receive tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 degrees F.
- B. Do not install resilient flooring until they are at the same temperature as the space where they are to be installed. Close spaces to traffic during resilient flooring installation.
- C. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

#### **1.07 SEQUENCING AND SCHEDULING**

- A. Do not install resilient flooring materials over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

## 1.08 EXTRA MATERIALS

- A. Refer to Section 01 78 43 (01790)

## 1.09 PRODUCTS

### 1.10 VINYL COMPOSITION TILES

- A. Manufactures:
  - 1. Armstrong World Industries, Inc. (800-442-4212 x 2)
  - 2. Approved Manufacturers: Refer to Finish Schedule
  - 3. Materials:
    - a. All vinyl tile shall be the maximum extent possible of a single batch number. Tile should have uniform disbursement of color and texture throughout the thickness of the tile. Comply with ASTM F1066, Composition 1 (nonasbestos formulated)
    - b. Product, Size and Color: Refer to Interior Finish Index
    - c. Slip Resistance (Static coefficient of friction per ASTM C1028):
      - 1) Dry: 0.63
    - d. Vinyl Composition Floor Tile Adhesives: Provide water-resistant type recommended by tile manufacturer to suit floor tile and substrate conditions indicated.
      - 1) Manufactures:
        - (a) None
      - 2) Approved Manufacturers:
        - (a) "Ultrabond ECO 360"; Mapei Corp. (800-426-2734)
        - (b) Approved Substitution as approved by tile manufacturer.

### 1.11 VINYL PLANK FLOORING TILES

- A. Manufactures:
  - 1. None
  - 2. Approved Manufacturers:
    - a. Mats Inc. (800-628-7462)
      - 1) Tiles: "Floorworks Planks"
      - 2) Underlayment: "Quiet Cushion Underfloor QC"
  - 3. Materials:
    - a. ASTM F1700, Class III, Type B.
    - b. Size: 6" x 36", or as shown in the Interior Finish Index.
    - c. Thickness: 3.0 mm
    - d. Model Number and Color: Refer to Interior Finish Index.
    - e. Underlayment:
      - 1) General: PVC Underlayment
      - 2) Critical Radiant Flux: 0.45 minimum by ASTM E468.
      - 3) Smoke Density: Less than 450 by ASTM E662
    - f. Adhesives:
      - 1) Manufactures:
        - (a) None
      - 2) Approved Manufacturers:
        - (a) "Perma-Bond Mat/Tile Adhesive"; PermaBond Engineering Adhesives (732-868-1372)

### 1.12 SHEET VINYL FLOORING

- A. Manufactures:
  - 1. None
  - 2. Approved Manufacturers:
    - a. BOLON, represented by VIIR (781-964-5456)
      - 1) Product: Refer to Interior Finish Index
    - b. Mats Inc. (800-628-7462)
      - 1) Underlayment: "Quiet Cushion Underfloor QC"

3. Woven Vinyl Sheet Flooring:
  - a. Woven Vinyl Sheet Flooring shall meet ASTM F1303, Type I, Grade 1, with Class B backing.
  - b. Sheet Width: Refer to Interior Finish Index
  - c. Nominal Thickness: Refer to Interior Finish Index
  - d. Color and Pattern: As shown in Interior Finish Index
  - e. Seams: Install using welded seam installation.
  - f. Meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
    - 1) Flame Spread Rating: 75 or less by ASTM E84.
    - 2) Smoke Density: Less than 450 by ASTM E662.
    - 3) Critical Radiant Flux: 0.45 minimum by ASTM E468.
  - g. All sheet vinyl shall be the maximum extent possible of a single batch number.
  - h. Underlayment:
    - 1) General: PVC Underlayment
    - 2) Critical Radiant Flux: 0.45 minimum by ASTM E468.
    - 3) Smoke Density: Less than 450 by ASTM E662
  - i. Adhesives:
    - 1) Manufactures:
      - (a) None
    - 2) Approved Manufacturers:
      - (a) "Perma-Bond Mat/Tile Adhesive"; PermaBond Engineering Adhesives (732-868-1372)

### 1.13 RESILIENT BASE

- A. Manufactures:
  1. None
  2. Approved Manufacturers:
    - a. Johnsonite, a Tarkett Group Company (800-899-8916)
  3. Resilient bases shall be 1/8" thick, size as shown in Interior Finish Index. Provide cove type at sheet vinyl, resilient tile flooring, and other hard surfaces. Job mitering of corners will not be permitted.
    - a. Color: Refer to Interior Finish Index.
  4. Resilient Base Adhesives: Non-Toxic, Low Odor, and Solvent Free with no alcohol, glycol, or ammonia. Adhesive shall be antimicrobial with no hazardous vapors and contain no carcinogenic materials, per OSHA Regulation 29 CFR 1910-1200. Provide product as recommended for intended installation, as approved by resilient base manufacturer.
    - a. Manufactures:
      - 1) None
    - b. Approved Manufacturers:
      - 1) "Ultrabond ECO 575"; Mapei Corp. (800-426-2734)
      - 2) Approved Substitution as approved by resilient base manufacturer.

### 1.14 PVC THRESHOLD

- A. Manufactures:
  1. None
  2. Approved Manufacturers:
    - a. "Carpet Insert Threshold Mouldings"; Johnsonite, a Tarkett Group Company (800-899-8916)
    - b. Products:
      - 1) Guestroom Entry Door: Refer to Interior Finish index and Design Guide Drawings.
      - 2) Guestroom Connecting Door: Refer to Interior Finish index and Design Guide Drawings.



3. Manufactured from a homogeneous composition of polyvinyl chloride (PVC), high quality additives, and colorants. All Threshold Mouldings shall comply with A.D.A. requirements of Section 4.5.2 Changes of Level. Standard formulation exceeds ASTM E648 Class 1 Flammability requirements.
  - a. Hardness - ASTM D2240 - Not less than 85 Shore A
  - b. Abrasion Resistance - ASTM D3389 - 0.22 mg/cycle
  - c. Slip Resistance - ASTM D2047 - Exceeds Federal Standards and ADA requirements of 0.6 for flat surfaces.
  - d. Fire Resistance:
    - 1) ASTM E648/NFPA 253 (Critical Radiant Flux) - Class 1.
    - 2) ASTM E662/NFPA 258 (Smoke Density) - 450 or less.
  - e. Adhesive: As recommended by Manufacturer for use intended.
  - f. Color: Refer to Interior Finish Index for color and other additional requirements.

### 1.15 TRANSITION EDGES

- A. Manufactures:
  1. Resilient Edge Trims and Transitions:
    - a. None
    - b. Straight Metal Edge Trims:
      - 1) None
    - c. Curved Metal Edge Trims:
      - 1) None
  2. Approved Manufacturers:
    - a. Resilient Edge Trims and Transitions:
      - 1) Marley Flexco Co., A Soflex Company (800-633-3151)
      - 2) Johnsonite, a Tarkett Group Company (800-899-8916)
      - 3) Burke Mercer Flooring Products, A Division of Burke Industries (800-669-7010).
    - b. Straight Metal Edge Trims:
      - 1) Schluter Systems (800-574-8481)
      - 2) Ceramic Tool Company, Inc. (CTC) (800-236-5230)
    - c. Curved Metal Edge Trims:
      - 1) Schluter Systems (800-574-8481)
  3. Model, Size and Color: Refer to Interior Finish Index.
  4. Furnish transition edges at the following locations:
    - a. Vinyl Composition Tile to Concrete
    - b. Vinyl Composition Tile to Carpet
    - c. Sheet Vinyl Flooring to Concrete
    - d. Sheet Vinyl Flooring to Carpet
    - e. Carpet to Carpet (Where thickness varies)
    - f. Carpet to Ceramic Tile

### 1.16 RESILIENT STAIR ACCESSORIES

- A. Stair Nosings:
  1. Manufactures:
    - a. None
    - b. Approved Manufacturers:
      - 1) Johnsonite, a Tarkett Group Company (800-899-8916)
      - 2) Burke Mercer Flooring Products, A Division of Burke Industries (800-669-7010).
      - 3) Roppe Corporation (800-537-9527)
  2. Model, Size and Color: Refer to Interior Finish Index.

### 1.17 INSTALLATION ACCESSORIES

- A. Concrete Leveling and Patching compounds:
  1. For areas up to 4 square feet:
    - a. Feather finish, use to smooth ridges, fill cracks, gouges and joints.

- 1) "SD-F"; Ardex (724-203-5000)
- 2) "Planiprep FF"; Mapei Corp. (800-426-2734)
- 3) "Versa Patch"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
- 4) "NXT Level Plus with NXT Primer"; Laticrete International Inc. (800-243-4788)
- 5) Trowelable underlayment patch for thickness from feather edge to 3 inch without aggregate
  - (a) "Quickpatch"; Mapei Corp. (800-426-2734)
  - (b) "Fast Set Deep Patch"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
  - (c) "NXT Level Plus with NXT Primer"; Laticrete International Inc. (800-243-4788)
- 6) Trowelable underlayment patch for thickness up to ½ inch without aggregate; up to 1 inch with aggregate. Can be feather edged.
  - (a) "SD-P/ Primer P-82"; Ardex (724-203-5000)
- b. For areas exceeding 4 square feet:
- c. Self-leveling, pourable or pumpable underlayment for thicknesses up to 5 inches. Can be feather edged.
  - 1) "K-15/Primer P-51"; Ardex (724-203-5000)
  - 2) "Novoplan 2/Primer"; Mapei Corp. (800-426-2734) (Note: Refer to product datasheet for specific requirements based on substrates)
  - 3) "EZ Level TA-323/Multi Purpose Primer"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
  - 4) "NXT Level with NXT Primer"; Laticrete International Inc. (800-243-4788)
2. Concrete Slab Primer:
  - a. Vinyl Composition Tiles
    - 1) Non-staining type as recommended by flooring manufacturer.
  - b. Sheet Vinyl Flooring:
    - 1) Manufactures:
      - (a) "S-185 Latex Primer and Additive"; Armstrong World Industries, Inc. (800-442-4212 x 2)
    - 2) Approved Manufacturers:
      - (a) Approved Substitution
3. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer for applications indicated.
  - a. Vinyl Composition Tiles
    - 1) As recommended by flooring manufacturer.
  - b. Sheet Vinyl Flooring:
    - 1) Manufactures:
      - (a) "S-184 Fast-Setting Cement-Based Patch and Skim Coat"; Armstrong World Industries, Inc. (800-442-4212 x 2)
    - 2) Approved Manufacturers:
      - (a) Approved Substitution
4. Other materials, including edge strips not specifically described, but required for a complete and proper installation of resilient flooring, shall be only as recommended by the manufacturer of material to which it is applied.

## 1.18 EXECUTION

## 1.19 INSPECTION

- A. Installer must examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

1. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
2. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

## **1.20 CONCRETE SUBFLOORS OR GYPSUM CEMENT FLOOR UNDERLAYMENT**

- A. Verify that concrete slabs comply with ASTM F710 and the following:
  1. Slab substrates are dry and free of curing compounds, sealers, hardeners, residual adhesives, adhesive removers, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer.
  2. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section, "Cast-In-Place Concrete" for slabs receiving resilient flooring.
  3. Subfloor Moisture Conditions: Before installing flooring Contractor shall verify that Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1, with subfloor temperatures not less than 55 deg F, or as recommended by manufacturer.
  4. Subfloor Alkalinity Conditions: Before installing flooring Contractor shall verify that a pH range of 5 to 9 when subfloor is wetted with potable water and pHydron paper is applied

## **1.21 PREPARATION**

- A. General: Comply with manufacturer's installation specifications for preparing substrates to receive products indicated.
  1. Comply with Armstrong Guaranteed Installation Manual F-5061, or equivalent by other listed manufacturers.
  2. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.
  3. This Contractor to remove coatings, including curing compounds, adhesives, plastics, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush. Surface to receive new flooring shall be fully prepared, including removal of existing materials not acceptable for proper installation of new materials, as required by manufacturer. Do not use solvents.
    - a. Prep floor according to ASTM F710 criteria.
  4. Slab Primers:
    - a. Gypsum Cement Floor Underlayment: Apply to gypsum subfloor liberally with a short nap paint roller or a coarse fiber brush. Avoid puddling. Use at full strength, DO NOT DILUTE.
    - b. Allow to dry thoroughly before skimming with floor patch
  5. Underlayment or Leveling Compound: Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors. All rough areas, projections, ridges, and bumps shall be removed.
    - a. Apply leveling compound in compliance with manufacturer's directions.

## **1.22 INSTALLATION - GENERAL**

- A. Install flooring after finishing operations, including painting, have been completed. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by flooring manufacturer's directions.
- B. Patch and repair floors and walls to receive flooring for proper installation of flooring, stair accessories, and base.
- C. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces and edgings. Scribe around obstructions and to produce neat joints, laid tight, even, and straight. Extend flooring into toe spaces.

- D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.
- E. Install flooring on covers for telephone and electrical ducts and other such items as occur within finished floor areas.
- F. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.
- G. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.

### **1.23 INSTALLATION - VINYL COMPOSITION TILE FLOORS AND PLANK FLOORING TILES**

- A. Lay tile from center marks established from center of area so that tile at opposite edges of the area are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at edge perimeters. Lay tile square to room axis unless otherwise indicated.
- B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly in and around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable. Lay tile with grain in tile running in same direction.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- G. Vinyl Plank Flooring Tiles:
  - 1. Do not reverse pieces (TM edge to non-TM edge), if a seam is needed, seams should be positioned so that the ends of the planks are offset 3" to 6".

### **1.24 INSTALLATION - SHEET VINYL FLOORING**

- A. General: Comply with sheet vinyl floor covering manufacturer's written installation instructions.
- B. Unroll sheet vinyl floor coverings and allow them to stabilize before cutting and fitting, if recommended in writing by manufacturer.
- C. Lay out sheet vinyl floor coverings to comply with the following requirements:
  - 1. Maintain uniformity of sheet vinyl floor covering direction.
  - 2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 inches away from parallel joints in flooring substrates.
  - 3. Match edges of sheet vinyl floor coverings for color shading and pattern at sump according to manufacturer's written recommendations.
  - 4. Avoid cross seams.
  - 5. Install flooring wall-to-wall before the installation of floor-set cabinets, casework, furniture, equipment, moveable partitions and similar moveable objects.
  - 6. Scribe, cut, and fit or flash cove to permanent fixtures, built-in furniture and cabinets, pipes and outlets, and permanent columns, walls, and partitions as shown on Drawings.
  - 7. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.
  - 8. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.

9. Install sheet vinyl floor coverings on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
10. Adhere sheet vinyl floor coverings to flooring substrates to comply with floor covering manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
  - a. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
11. Chemically-Welded Seams: Chemically weld seams with seam sealer as recommended by flooring manufacturer into a seamless floor covering. Prepare, weld, and finish seams according to manufacturers written instructions and ASTM F1516 to produce surfaces flush with adjoining floor covering surfaces. Adhesive residue in the seams will not be acceptable.
12. Hand roll sheet vinyl floor coverings directions with a 100 pound roller in both directions from center out to embed floor coverings in full spread of adhesive and eliminate trapped air. At walls, door casings, and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.

#### **1.25 RESILIENT WALL BASE INSTALLATION**

- A. At areas where base is required, apply resilient base to walls, columns, pilasters, casework, and other permanent fixtures, as coordinated with type of flooring. Install base in as long lengths as practicable. Tightly bond base to backing throughout the length of each piece with continuous contact at horizontal and vertical surfaces. On irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- B. Job-Formed Corners:
  1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

#### **1.26 ACCESSORIES**

- A. Place resilient edge strips tightly butted to adjacent materials of type indicated and bond to substrates with adhesive. Install edging strips at all unprotected edges of flooring unless otherwise shown. Apply resilient accessories to stairs and risers as indicated and according to manufacturer's installation instructions.
- B. Stair Nosings:
  1. Use stair-tread-nose filler, according to resilient tread manufacturer's written instructions, to fill nosing substrates that do not conform to tread contours.
  2. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

#### **1.27 CLEANING AND PROTECTION**

- A. Perform the following operations immediately after installing resilient floor coverings:
  1. Remove adhesive and other surface blemishes using cleaner recommended by floor covering manufacturer.
  2. Sweep or vacuum floor thoroughly.
  3. Do not wash floor covering until after time period recommended by floor covering manufacturer.
  4. Damp-mop floor to remove marks and soil.
  5. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction

period. Use protection methods indicated or recommended by manufacturer of resilient product involved.

6. Cover sheet vinyl floor coverings with undyed, untreated building paper or the application of two coats of a high quality acrylic floor finish such as Ecolabs "Gemini Gemstar" or Armstrong "S-480 Commercial Floor Polish "can be applied to protect the floor during construction until inspection for Substantial Completion.
7. Clean products specified in this Section not more than four days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products using method recommended by manufacturer. Strip protective floor polish that was applied after completing installation, prior to cleaning.
8. Do not move heavy and sharp objects directly over resilient floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

#### **1.28 FINISHING**

- A. After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories.
  1. Vinyl Composition Tile: Apply wax and buff with type of wax, number of coats, and buffing procedures in compliance with flooring manufacturer's instructions.
  2. For Amtico International flooring materials, follow strict instructions by manufacturer. Do NOT apply wax coating.
  3. Sheet Vinyl Flooring: Apply two (2) coats of a high quality acrylic floor matte shine finish (high gloss is not permitted) such as "Taski's Ombra Matte Shine Floor Finish" by Lever Industrial (800-827-5487), or approved substitution by Ecolabs, as approved by flooring manufacturer.

**END OF SECTION**

## SECTION 09 68 00

### CARPETING

#### GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Preparation of Surfaces to Receive Carpeting.
  - 2. Carpet:
    - a. Furnished by Owner, installed by Contractor
    - b. Stretch-in Installation
    - c. Direct-Glue-Down Installation
    - d. Double-Glue-Down Installation
    - e. Carpet with Attached-Cushion Installation
    - f. Carpet with Preapplied Adhesive Installation
  - 3. Carpet Cushion:
    - a. Furnished by Owner, installed by Contractor
  - 4. Accessories, including tack strips, adhesives tapes and all other required accessories.
  - 5. Transition edges
  - 6. Carpet stair nosings
- B. Related Documents:
- C. Related Sections:
  - 1. Section 03 30 00 (03300) - Cast-in-Place Concrete
  - 2. Section 03 54 13 (03500) - Cementitious Decks and Underlayment
  - 3. Section 09 65 00 (09650) - Resilient Flooring

##### 1.02 REFERENCES

- A. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials):
  - 1. D5116 "Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products"
  - 2. F710 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring"
  - 3. F1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"
- B. Federal Specifications (FS)
  - 1. FS DDD-C-0095 Carpet and rugs, wool, nylon, acrylic, modacrylic, polyester, polypropylene
- C. Carpet & Rug Institute (CRI) Publications:
  - 1. CRI 104 Carpet Installation Standard
- D. Occupational Safety & Health Administration (OSHA) Regulations:
  - 1. OSHA Regulation 29 CFR Toxic and Hazardous Substances 1910-1200 Hazard Communication
- E. U.S. Department of Commerce (DOC) Publications:
  - 1. Federal Flammability Standard DOC FF 1-70 (Methenamine Pill test ASTM D2859).

##### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. A copy of the manufacturer's printed installation manual shall accompany Bid for review and approval by the Owner's Representative.
  - 2. Shop Drawings showing layout and seaming diagrams. Indicate pile or pattern direction and locations and types of edge strips. Indicate columns, doorways, enclosing walls or

partitions, built-in cabinets, and locations where cutouts are required in carpet. Show installation details at special conditions.

#### **1.04 QUALITY ASSURANCE**

- A. Installer Qualifications: Firm with not less than 5 years of experience in installation of commercial carpeting of type, quantity, and installation methods similar to work of this Section, or can demonstrate compliance with its certification program requirements.
- B. Successful vendor shall be responsible for field measurements to determine carpet layout.
- C. All products shall comply with the Carpet and Rug Institute Indoor Air Quality Testing Program (Green Label).
- D. Carpet Surface Burning Characteristics: Provide carpet identical to that tested for the following fire performance characteristics, per test method indicated below, by UL, ASTM E648, or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet with appropriate markings of applicable testing and inspecting organization.
  - 1. Test Method: DOC FF 1-70
  - 2. Rating: Pass
- E. The carpet contractor is responsible for reviewing carpet manufacturer's published installation instructions prior to installation. This includes understanding dye lots, pattern sequencing, pattern matching and any special instructions. Failure to abide by the manufacturer's instructions could result in a backcharge to contractor for corrections to the installation.
- F. Contractor is responsible for damages to work performed by others including but not limited to telephone or television wires placed in front of the tack-strip running the perimeter of the room.
- G. The installation contractor is responsible for verification of quantities within [fourteen (14) days] on new construction. The contractor shall provide take-offs of all carpet and padding, as required for a complete installation. No compensation will be allowed to the installation contractor for materials and labor that may be required to install additional carpeting because of incorrect quantity takeoffs.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 05: "Storage and Handling".
- B. Do not deliver carpet until areas of building are ready for carpet installation. Provide protection from loss or damage.
- C. Store materials in original undamaged packages and containers, inside well-ventilated, dry area protected from weather, moisture, soilage, extreme temperatures and humidity. Lay flat, blocked off ground. Maintain minimum temperature of 68 degrees F. (20 degrees C.) at least three days prior to and during installation in area where materials are stored. Never stack carpet more than two rolls high or stand up on roll ends on job site. Do not bend or fold carpet in storing.
- D. Carpet shall never be stacked more than five (5) rolls high.

#### **1.06 PROJECT CONDITIONS**

- A. General: Comply with CRI 104, Section 07: "Site Conditions".
- B. Do not commence with carpet installation until painting and finishing work is complete and ceilings and overhead work has been tested, approved, and completed.
- C. In areas to receive carpet, room temperatures shall be maintained at 65-90 degrees F and with relative humidity ranging between 20 and 65 percent minimum for 72 hours prior to, during, and 72 hours following application. Materials shall be conditioned at application temperature and humidity at least 24 hours prior to application. Provide sufficient lighting for carpet installation.
- D. Contractor shall provide method approved by the [Architect] [Owner's Representative] to mechanically exhaust all spaces to receive carpet to the exterior during installation and a minimum of 72 continuous hours, or length of time required by the manufacturer or Owner after installation.



- E. Subfloor Moisture Conditions: Before installing carpet Contractor shall verify that Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1, with subfloor temperatures not less than 55 deg F, or as recommended by manufacturer.
- F. Subfloor Alkalinity Conditions: Before installing carpet Contractor shall verify that a pH range of 5 to 9 when subfloor is wetted with potable water and pHDrion paper is applied.

## **1.07 WARRANTY**

- A. Stretch-in installation labor shall be guaranteed for one (1) year. Sixty days after installation, the
- B. Tred-Mor Dubl-Stik installation labor shall be guaranteed for five (5) years.
- C. The adhesive manufacturers offer five (5) year warranty on their adhesives used on a Tred-Mor Dubl-Stik installation.
- D. It is the carpet Contractors responsibility to fill out the adhesive manufacturer warranties. The warranty must be returned to the adhesive manufacturer and a copy sent to the Contractor's representative.

## **1.08 EXTRA MATERIALS**

- A. Refer to Section 01 78 43 (01790) for requirements.

## **PRODUCTS**

### **2.01 MATERIALS**

- A. Carpet: Refer to Interior Finish Index

### **2.02 CARPET CUSHIONS**

- A. The following carpet cushion information is provided solely for use by the Contractor to determine locations.
- B. Rubber padding - 50 oz. Badger waffle type pad shall be installed in Guest Rooms and suites unless TredMor pad is specified.
- C. Rubber padding - 68 oz. Granite IV flat type pad shall be installed in Public Areas and Guest Room Corridors unless Tred-Mor pad or direct glue-down is specified.
  - 1. Rubber padding shall be cemented to the floor with a liquid mastic around the perimeter and in an use pattern across the field.
  - 2. Rubber padding joints shall be at a right angle to all carpet seams. When this is not practical, shift the pad so that the joints are several inches from the carpet seams. All padding joints shall be taped.
- D. Tred-Mor Padding:
  - 1. 1562 used in Ambulatory Guest Rooms (except at ADA accessible Guest Rooms)
  - 2. 2568 used in Guest Room Corridors and other Public Areas not listed below
  - 3. 2580 used in Assembly Areas

### **2.03 ACCESSORIES**

- A. Seaming: Hot-melt seaming adhesive or similar product recommended by carpet manufacturer for taping seams and buttering cut edges at backing to form secure seams and prevent pile loss at seams.
- B. Hot melt tape - (all stretch installation areas except Dubl-Stik installations)
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "6 inch - Super 3S Tape"; ORCON (800-227-0601)
- C. Carpet and Accessory Adhesives: (All direct glue-down areas except double-stik installations)
  - 1. Non-staining type as recommended by carpet manufacturer for use intended, complying with the following:

- a. Adhesive: As recommended by carpet manufacturer for use intended, complying with the following: Adhesive shall be antimicrobial with no hazardous vapors and contain no carcinogenic materials, per OSHA Regulation 29 CFR 1910-1200. All containers shall contain material safety data sheets (MSDS) and be available at job site for inspection.
- D. Carpet Adhesive - Dubl-Stik Installation
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "SS-5" ("Safe-Set"); CHAPCO (Chicago Adhesive Products, Co.) (800-621-0220)
    - b. "Parabond" Dubl-Stik DS-902; Para-Chem, Inc. (800-763-7272)
    - c. "ECO 220"; Mapei Corp. (800-426-2734)
- E. Carpet Seam Adhesive - Dubl-Stik Installation
1. This product shall be used to join the primary backs of tufted carpet and the woven backs of Axminster carpet together.
    - a. All seam adhesives shall be latex type.
  2. Preferred Manufacturers:
    - a. None
  3. Approved Manufacturers:
    - a. "Seam Cement #112"; CHAPCO (Chicago Adhesive Products, Co.) (800-621-0220)
    - b. "Parabond Premium Latex Seam Sealer M267"; Para-Chem, Inc. (800-763-7272)
    - c. "Ultrabond ECO 2085"; Mapei Corp. (800-426-2734)
- F. Hot Melt Tape - Dubl-Stik Installation
1. Preferred Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "CT-7DS"; ORCON (800-227-0601)
  3. NOTE: MANDATORY USE WITH BRINTONS AND COURISTAN CARPETS
  4. The use of hot melt tape is optional and depends on the carpet installer's preference. There are instances during some installations, such as pattern matching, where the hot melt tape may simplify and speed up installation.
  5. CAUTION: DO NOT USE A SILICONE TREATED TAPE. THE SILICON WILL PREVENT THE ADHESIVE FROM ADHERING TO THE BACK SIDE OF THE TAPE.
- G. Tack Strips:
1. Water-resistant plywood strips as required to match pad thickness and in compliance with CRI 104, Section 11.3.
  2. Commercial with 3 rows of pins.
    - a. Type 1: Pre-nailed (Concrete) for anchoring into concrete sub-floor.
    - b. Type 2: Extra long nails for cementitious leveling bed over plywood sub-floor.
- H. Concrete Leveling and Patching compounds:
1. For areas up to 4 square feet:
    - a. Feather finish, use to smooth ridges, fill cracks, gouges and joints.
      - 1) "SD-F"; Ardex (724-203-5000)
      - 2) "Planiprep FF"; Mapei Corp. (800-426-2734)
      - 3) "Versa Patch"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
      - 4) "NXT Level Plus with NXT Primer"; Laticrete International Inc. (800-243-4788)
    - b. Trowelable underlayment patch for thickness from feather edge to 3 inch without aggregate
      - 1) "Quickpatch"; Mapei Corp. (800-426-2734)
      - 2) "Fast Set Deep Patch"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
      - 3) "NXT Level Plus with NXT Primer"; Laticrete International Inc. (800-243-4788)

- c. Trowelable underlayment patch for thickness up to ½ inch without aggregate; up to 1 inch with aggregate. Can be feather edged.
  - 1) "SD-P/ Primer P-82"; Ardex (724-203-5000)
2. For areas exceeding 4 square feet:
3. Self-leveling, pourable or pumpable underlayment for thicknesses up to 5 inches. Can be feather edged.
  - a. "K-15/Primer P-51"; Ardex (724-203-5000)
  - b. "Novoplan 2/Primer"; Mapei Corp. (800-426-2734) (Note: Refer to product datasheet for specific requirements based on substrates)
  - c. "EZ Level TA-323/Multi Purpose Primer"; TEC Specialty Products, H.B. Fuller Construction Products, Inc. (800-832-9023)
  - d. "NXT Level with NXT Primer"; Laticrete International Inc. (800-243-4788)

## 2.04 TRANSITION EDGES

- A. Carpet Transition Edges: Refer to Interior Finish Index and Section 09 65 00 (09650).

## EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Concrete Subfloors: General Contractor shall verify that concrete slabs comply with ASTM F710 and the following:
  1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet and carpet cushion manufacturers, including ASTM F1869. It is essential that moisture tests be taken on all concrete floors regardless of age and grade level. The test should be in accordance with ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride. One test should be conducted for every 1000 sq. ft. of flooring and the results not exceed 3 lbs. Per 1000 sq. ft. in 24 hours. If the test results exceed the limitations, the installation must not proceed until the problem has been corrected.
  2. Subfloor Alkalinity Conditions: Before installing carpet Contractor shall verify that a pH range of 5 to 9 when subfloor is wetted with potable water and pHydration paper is applied.
  3. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet.
  4. Subfloors are free of cracks, ridges, depressions, scale and foreign deposits. Sand smooth or fill voids to obtain a smooth level substrate, any noticeable deviation in flooring may be rejected.
  5. Ensure floors are level with maximum surface variation of ¼" in 10'.
- C. Report conditions contrary to Contract requirements which would prevent a satisfactory installation. Proceed with installation only after unsatisfactory conditions have been corrected, as approved by General Contractor.
  1. Failure to call attention to any defects or imperfections will be construed as acceptance and approval of the subfloor.
  2. Installation indicates acceptance of substrate conditions at the time of installation.

### 3.02 SITE ENVIRONMENTAL PROCEDURES

- A. Indoor Air Quality:
  1. Temporary ventilation:
    - a. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum

for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by Architect.

2. Immediately after installation, clean carpet thoroughly with a high-efficiency particulate air (HEPA) filtration vacuum.

### **3.03 PREPARATION**

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written instructions for preparing substrates indicated to receive carpet installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
  1. Level subfloor within 1/4" in 10', noncumulative, in all directions. Sand or grind protrusions, bumps, and ridges. Patch and repair cracks and rough areas. Fill depressions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:
  1. Carpet manufacturer
  2. Carpet cushion manufacturer

### **3.04 INSTALLATION**

#### **3.05 RETAIN PARAGRAPHS BELOW FOR TYPE OF INSTALLATION USED ON PROJECT. DELETE PARAGRAPHS NOT USED.**

- A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation"
  1. In the case of direct glue-down, carpet glued to floor, no padding required, follow the manufacturers specifications.
  2. Milliken modular carpets and Collins & Aikman uniback carpet requires the use of their own adhesives when installing their products.
- B. Double-Glue-Down Installation: Comply with CRI 104, Section 9, "Double Glue-Down Installation"
- C. Carpet with Attached-Cushion Installation: Comply with CRI 104, Section 10, "Attached Cushion"
- D. Carpet with Preapplied Adhesive Installation: Comply with CRI 104, Section 10.4, "Pre-Applied Adhesive Systems"
- E. Stretch-In Installation: Comply with CRI 104, Section 11, "Stretch-In Installation"
  1. Install tack strip with adhesive, drill and pin, or nailing, or combination, where required for adequate strength.
  2. Locate Tack strip 1/4 inch from wall to conceal carpet edge between stripping and base of wall. Strip entire perimeter of each carpeted space and at obstructions and cutouts.
  3. Tap down tackstrip pins in Guestrooms at Entrances, Bathroom, Closets, and Balconies.
  4. Tred-Mor Pad Installation
    - a. Refer to Scope of Work, and the Interior Design Drawings, for Tred-Mor pad locations. Tred-Mor padding will be installed using the stretch-in installation method listed above unless Tred-Mor Dubl-Stik is specified.
  5. Power stretch carpet uniformly in both directions the exact amount recommended by carpet manufacturer; trim edges, secure to stripping and conceal behind edge of stripping.
    - a. Stretch-in installations must be power stretched uniformly length and width 1% to 1.5% using a power stretcher.
    - b. When Graphic Action Back Carpet is specified, a uniform length and width power stretch of .75 % to 1% is acceptable.
  6. Use a carpet covered minimum 48 inch long 4 x 4 buffer block between power stretcher and wall to prevent damage to wall. Use a wall trimmer to trim carpet along walls and abutments. This Contractor shall be responsible for wall damage caused by installation Work.
    - a. Trimmer must be adjusted to leave sufficient excess carpet to tuck into gullies.

- F. Stair Installation: Comply with CRI 104, Section 12, "Carpet on Stairs"
- G. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
  - 1. Level adjoining border edges
- H. Do not bridge building expansion joints with carpet.
- I. Cut and fit carpets to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
  - 1. Check matching of carpet before cutting and ensure there is no visible variation between cut pieces.
  - 2. Cut carpet, where required, in a manner to allow proper seam and pattern match. Ensure cuts are straight and true and unfrayed.
- J. Carpet shall extend to the back of all toe spaces, under all millwork, cabinetwork, convectors, bookshelving, and similar items to the limiting planes of the floor surface. Where carpet terminates at a doorway, termination of carpet shall occur under the edge of the closed door, or at the side of the threshold where this is required. Cut and fit carpeting to all obstructions protruding from the floor surface, such as columns, pipes, thresholds, electrical, and telephone outlets, etc. All raw edges shall be sealed and securely and neatly tucked into place.
- K. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- L. Install pattern parallel to walls and borders.
- M. Carpet shall be installed by experienced carpet layers in an approved manner. Install carpet with pile running in the same direction, unless specifically directed to do otherwise.
- N. Install carpet cushion seams at 90-degree angle with carpet seams.
- O. The final carpet pattern, layout, edge binding locations shall be as directed and approved by Owner's Representative. All associated installation shall be by this Contractor.

### **3.06 INSTALLATION - TRED-MOR DUBL-STIK**

- A. Glue-Down Cushion - Pressure Sensitive Adhesive:
  - 1. After all floor preparation is completed, the layout of the cushion should be planned. Cushion should be installed in longest lengths possible with consideration for traffic patterns and seam placement. Cushions seams should not be directly under carpet seams and generally should be at right angles to them. When this is not possible, shift cushion or carpet so that cushion seams are at least 6" to one side of carpet seams. After completing the cutting and fitting, begin gluing. Fold back the cushion and begin applying the adhesive to the floor. Refer to adhesive manufacturer's instructions for trowel size. Coat the floor with a continuous thin film of adhesive. A thick film will not be permitted. The optimum time to install cushion onto the adhesive is after the adhesive has become tacky dry. Do not lay the cushion into wet pressure sensitive adhesive.
  - 2. Gluing Cushion to Floor:
    - a. Pressure Sensitive Adhesive: For most installations, a 1/32" x 1/32" x 1/32" trowel size will be sufficient. However, if floor is very porous (rough concrete, particle board, plywood, etc.), a larger trowel notch may be required. Some pressure sensitive adhesives can be applied more quickly to smooth subfloors by using a short nap paint roller. Comply with the adhesive manufacturer's instructions covering the specific adhesive. After adhesive application has been completed, place the cushion onto the adhesive and adjust where necessary to ensure there are no gaps at seams and whether full contact is made with adhesive. Smooth out air bubbles with a 2' piece of carpet core or the bottom of a tool box shelf.
  - 3. Glue Down Carpet to Cushion:

- a. Multipurpose - Carpet Adhesive - Premium Quality: For use between the cushion and tufted carpets with a secondary back or woven carpets, only a quality Brand Premium Adhesive should be used. Conform to manufactures recommendations and spread with a properly selected notched trowel. Maintain proper notch size throughout the installation.
- b. Laying Out Carpet and Installing: Follow industry accepted methods for a glue-down installation. All carpet should be spread in the room 24 hours prior to actual installation with room temperature between 65 degrees and 95 degrees F. Open carpet and spread it out over cushion. Roughly locate the carpet three to four inches longer than the area measurement. Align all breadths in their proper positions and trim the seams. All seam edges must be trimmed using the appropriate seam cutting tools, according to the carpet manufacturer's recommendations, before spreading the adhesives. Do not double cut carpet seams where cutting tool will penetrate the cushion; this can weaken the finished seam. Select the appropriate adhesive and trowel notching, as recommended for the coarseness of the carpet backing. On tufted carpets with a secondary back and on woven carpets, the trowel notch shall be large enough for the adhesive to make good contact with the recessed areas of the backing. Very coarse textured backings, rough porous concrete surfaces, or other unusual conditions, can require a trowel with deeper notches as recommended by the adhesive manufacturer. Lack of adhesion caused either by a lower quality adhesive or wrong trowel selection is the number one cause of installation failure.
- c. The adhesive is to be spread uniformly over the cushion with selected trowel. After sufficient open time, the carpet should be pressed down into the adhesive using a 2-foot section of carpet tube or a stiff bristlebroom (not nylon), or a roller weighing no more than 35 pounds.
- d. The following types of carpet can be glued down to cushion: woven wilton, woven axminster, tufted with secondary backing of jute or synthetic, tufted carpet with no secondary backing (unitary backing), tufted carpet with thermo-plastic (hot melt) application of secondary backing of jute or polypropylene, or cushion-bonded.
- e. Floor preparation and testing, as well as cutting, fitting and laying of cushion and carpet are essentially the same for all types. However, the type of adhesive and the depth of the notches in the trowel (which controls the amount of adhesive being applied) depends on whether you are installing cushion or the carpet and on what type floor and carpet backing. Refer to carpet manufacturer or adhesive manufacturer's instructions for recommendations.

### **3.07 SEALING CUT EDGES**

- A. To prevent fraying and raveling at all seams and transition areas, a continuous bead of seam adhesive must be applied to the first edge where the face yarn enters the backing.
- B. On woven carpet, all cut edges at seams and transition areas must be secured with a latex seam adhesive immediately following the seam trimming.

### **3.08 SEAMING**

- A. Install pad and carpet seams in accordance with manufacturer's published instructions.
- B. Locate pad seams at right angles to carpet seams. Where not possible to locate at right angles, locate pad seam minimum 6 inches away from carpet seams. Butt pad edges tightly together to form seams without gaps. Tape pad seams.
- C. Maintain uniformity of carpet direction and lay of pile. At doors, center seams under doors; do not place seams in traffic direction at doorways.
- D. Orcon Super 3S Wide tape will be used on all public area seams specifying hot melt tape.
- E. The seaming iron with heat shield must be of proper size, matching the hot melt tape being used.
- F. The proper head setting and exposure time must be used to assure proper transfer without creating damage to backing or pile yarn.

- G. Orcon Super 3S tape will be used in Guest Rooms and suites where seams are specified.
- H. Cutting and Seaming Plan:
  - 1. Guest Room and Suites: Refer to the Interior Design Drawings seaming layouts.
    - a. Public Areas: Refer to the Interior Design Drawings seaming layouts and the carpet suppliers seaming layouts.
- I. Where conflicts between Owner's requirements and manufacturer's requirements occur, use Owner's requirements.

### **3.09 ACCESSORIES**

- A. Provide carpet edge guard where edge of carpet is exposed; anchor guards to substrate. Edge guard shall be used in all doorways or openings where no sill is installed or as required.
- B. Stair Nosing: Coordinate with installation of carpet so that edge of the carpet is installed under edge of nosing or otherwise protected from unraveling.
- C. Base (in corridors): Carpet Base, to match adjacent floor.
  - 1. Install carpet base prior to installing carpet, aligned straight and level. Neatly fit against floor carpet.
  - 2. Fix the carpet base to walls using a manufacturer approved adhesive. Mechanically attach the base to the wall at the bottom edge of surging when required. Staples shall not be permitted.

### **3.10 ADJUSTING**

- A. Stretch-In Installation: Restretch carpet sixty days after Substantial Completion, as directed by Owner.

### **3.11 CLEANING AND PROTECTION**

- A. Comply with CRI 104, Section 15, "Protection of Indoor Installation".
- B. Remove and dispose of debris and unusable scraps daily.
- C. Vacuum carpet daily using commercial machine with face-beater element. Remove spots and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors. Knock down tacks at entries to baths and guest rooms (to protect feet).
- D. Maintenance Materials: Deliver specified overrun (if any) and usable scraps of carpet to Owner's designated storage space, properly packaged (paper wrapped) and identified. Usable scraps are defined to include roll ends of less than 9'-0" length, and 3'-0" wide. Dispose of smaller pieces as "construction waste".
- E. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

### **3.12 NOTE: TO BE USED FOR ALL BRANDS**

**END OF SECTION**

## SECTION 09 90 00

### PAINTING

#### GENERAL

##### 1.01 SUMMARY

A. Section Includes:

1. This Section includes surface preparation and the application of paint materials to exposed interior and exterior items and surfaces scheduled. Surface preparation, prime and finish coats specified are in addition to shop-priming and surface treatments.
2. Paint all exposed surfaces, whether or not colors are designated, except where a surface or material is indicated not to be painted or is to remain natural. Where an item or surface is not mentioned, paint the same color as similar adjacent materials or surfaces. If color or finish is not designated, the Owner will select from standard colors or finishes available.
3. Except in mechanical and electrical rooms, paint all exposed plumbing, heating, fire protection, and electrical material to match the walls and ceilings of that area unless noted otherwise. This shall include, but not be limited to, pipes, sprinkler piping, insulation, conduit, ducts, access panels, grilles, diffusers, hangers, exposed steel and iron supports, HVAC and electrical equipment that do not have a factory applied finish, whether the adjacent surfaces receive paint or not, and the like. Include dampers or baffles behind grilles.
4. Unless noted otherwise, painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, sprinkler heads, or labels.
  - a. All louvers and grilles to be painted to [match adjacent surfaces] [color as shown in Interior Finish Index] [.]
  - b. Labels: Do not paint over Underwriter's Laboratories, FMG or other code-required labels, or equipment name, identification, performance rating, or nomenclature plates.

B. Related Sections:

1. Section 08 11 13 (08110) - Steel Doors and Frames: Prime coat on new hollow metal work shall be furnished under this Section.
2. Prime coat on lintels shall be furnished under the Division 05 Sections.
3. Section 09 21 16 (09255) - Gypsum Board Assemblies: Spray applied textured coating specified in).
4. Section 09 96 00 (09960) - High-Performance Coatings: Prime and finish coat for exposed exterior ferrous metal items [and ferrous metal items located within Interior Pool areas] shall be furnished under that Section. Refer to that Section for items included.

##### 1.02 REFERENCES

A. Underwriter's Laboratories, Inc. (UL) Standards

B. FM Global (FMG): Standards

C. ASTM International (ASTM) Publications:

1. D16 "Standard Terminology for Paint, Related Coatings, Materials, and Applications"
2. D2824 "Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered, Asbestos Fibered, and Fibered without Asbestos"
3. D1187 "Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Re-approved 2002)"

D. Society of Protective Coatings (SSPC)

1. Surface Preparation Standards and Specifications
  - a. SSPC-SP 1, "Solvent Cleaning"
  - b. SSPC-SP 11, "Power Tool Cleaning to Bare Metal"

E. The Painting and Decorating Contractors of America (PDCA)

1. PDCA P5-94 "Benchmark Sample Procedures for Paint and Other Decorative Coating Systems"

F. Master Painter's Institute, Inc. Publications:



1. MPI Architectural Painting Specification Manual"
- G. Code of Federal Regulations (CFR) Publications:
  1. 40 CFR, Part 59, Subpart D 2001, "National Volatile Organic Compound Emission Standards for Architectural Coatings"
- H. Green Seal, Inc. Publications:
  1. GS-11 "Green Seal Environmental Standard for Paints", First Edition 1993.
- I. U.S. Green Building Council's (USGBC) Publications:
  1. (LEED-NC) Version 2.2 "LEED for New Construction and Major Renovations"

### **1.03 DEFINITIONS:**

- A. General: Standard coating terms defined in ASTM D16 apply to this Section.
- B. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

### **1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  1. Product Data: Submit manufacturer's technical information, label analysis, and application instructions for each paint material proposed for use.
  2. Samples: Submit two representative samples of each major type of surface or material. Do not proceed with final painting until samples are approved.
  3. Color Charts: In duplicate, for all paints, stains and special coatings. Identify with numbers used on the "Interior Finish Index" or on the Drawings.
  4. Painting Schedule: In a form similar to the schedule herein outlining the type of paint to be used for each category, application, and color. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  5. Quality Control Submittals:
    - a. Certifications: Manufacturer's statement that paint materials conform to current regulations relating to lead content and air pollution emission requirements.
- C. Written Permission in writing by the Owner's Representative for the use of Mechanical application methods.
  1. Submit Green Seal Certification to GS-11 and description of the basis for certification.
  2. Submit environmental data in accordance with Table 1 of E2129 for products provided under work of this Section.
  3. Emission Test Reports.

### **1.05 QUALITY ASSURANCE**

- A. Single Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. The Painting subcontractor shall have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.
- C. Coordination of Work: Review Sections in which primers are provided to ensure compatibility of the total systems for various substrates.
- D. Material Quality: Provide the manufacturer's best quality trade sale type paint material of the various types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude of equal products of other manufacturers.

- E. Conform to requirements of local authorities having jurisdiction in regard to the storage, mixing, application and disposal of all paint and related waste materials.
- F. Mockup:
  - 1. When requested by the [Architect] [Owner's Representative], prepare and paint designated surface, area, room or item (in each color scheme) to requirements specified herein, with specified paint or coating showing selected colors, gloss / sheen, textures and workmanship to the specified standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

#### **1.06 DELIVERY AND STORAGE**

- A. Deliver materials to the job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with trade name and manufacturer's instructions.
  - 1. Product Name or Title of Material
  - 2. Product Description (Generic Classification or Binder Type)
  - 3. Manufacturer's Stock Number and Date of Manufacture
  - 4. Contents by Volume, for Pigment and Vehicle Constituents
  - 5. Thinning Instructions
  - 6. Application Instructions
  - 7. Color Name and Number
  - 8. VOC Content
- B. Approved materials without the above information will NOT be allowed on the Project site.
- C. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 50 degrees F. in a well-ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary precautionary measures to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing, and application of coatings.

#### **1.07 PROJECT CONDITIONS:**

- A. Do not apply coatings in snow, rain, fog, or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 degrees F. above the dew point, or to damp or wet surfaces, unless otherwise permitted by manufacturer's printed instructions. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.
  - 1. Unless specifically pre-approved by [Architect] [Owner's Representative], and the applied product manufacturer, perform no painting or decorating work when the ambient air and substrate temperatures are below 50° F for both interior and exterior work.
  - 2. Perform no painting work when the maximum moisture content of the substrate exceeds:
    - a. 15% for wood.
    - b. 12 % for plaster and gypsum board.

#### **1.08 WASTE MANAGEMENT AND DISPOSAL**

- A. Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Obtain information on these controls from applicable government agencies having jurisdiction
- B. All waste materials shall be separated and recycled. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- C. To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

1. Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
  2. Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  3. Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  4. Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
  5. Empty paint cans are to be dry prior to disposal or recycling (where available).
  6. Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- D. Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Except where noted otherwise, all finishing materials, thinners, etc., shall be the best quality, first line materials as manufactured by one of the following manufacturers:
1. Avendra, LLC. Preferred Manufacturers:
    - a. Sherwin-Williams Co. (S-W) (800-321-8194)
  2. Approved Manufacturers:
    - a. Benjamin Moore & Co. (BM) (888-236-6667)
    - b. Glidden Professional, a PPG Industries Brand (888-615-8169)
    - c. PPG Architectural Finishes, Inc. - Pittsburgh Paints (888-441-9695)

### 2.02 PAINT MATERIALS - GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated.
1. Paint-material containers not displaying manufacturer's product identification will NOT be acceptable.
    - a. Recycled content paints and primers will not be permitted for interior or exterior application.
    - b. Toxicity/IEQ: Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.
      - 1) Interior paint: Comply with Green Seal GS-11.
      - 2) Exterior paint: Comply with Green Seal GS-11.
      - 3) All materials used shall be lead and mercury free.
- C. Raw linseed oil, turpentine, benzene, gloss oil, or coal oil shall not be used in any of the materials for painting work.
- D. Chemical Components of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:

1.	Flat Paints, Coatings and Primers:	Not more than 50 g/L.
2.	Non-Flat Paints, Coatings and Primers:	Not more than 150 g/L
3.	Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals:	Not more than 250 g/L
4.	Floor Coatings:	Not more than 250 g/L
5.	Stains:	Not more than 250 g/L

6.	Clear Wood Finishes, Varnishes and Sanding Sealers:	Not more than 350 g/L
7.	Clear Wood Finishes, Lacquers:	Not more than 550 g/L
8.	Exterior Flat Paints, Coatings and Primers:	Not more than 100 g/L
9.	Exterior Non-Flat Paints, Coatings and Primers:	Not more than 150 g/L

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

- a. Acrolein.
- b. Acrylonitrile.
- c. Antimony.
- d. Benzene.
- e. Butyl benzyl phthalate.
- f. Cadmium.
- g. Di (2-ethylhexyl) phthalate.
- h. Di-n-butyl phthalate.
- i. Di-n-octyl phthalate.
- j. 1,2-dichlorobenzene.
- k. Diethyl phthalate.
- l. Dimethyl phthalate.
- m. Ethylbenzene.
- n. Formaldehyde.
- o. Hexavalent chromium.
- p. Isophorone.
- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

### 2.03 SPAR VARNISH

- A. Modified alkyd resin meeting federal regulations for lead and other heavy metals.
- B. Clear, gloss finish.
- C. Apply varnish on exposed ends of millwork as required in Section 12 30 00 (06400) - Architectural Woodwork and all field cuts in top and bottom rails of wood doors shall be sealed with two coats of varnish.

### 2.04 GERMICIDAL DETERGENT: (USE IF MOLD AND MILDEW HAS BEEN FOUND)

- A. Avendra, LLC. Preferred Manufacturers:
  1. None
- B. Approved Manufacturers:
  1. "X-14 Professional Instant Mildew Stain Remover"; WD-40 Company (888-324-7596)
  2. "Tilex Mold & Mildew Remover"; Clorox Co. (800-227-1860)
  3. "Tilex Mildew Root Penetrator and Remover"; Clorox Co. (800-227-1860)

### 2.05 PROTECTIVE COATINGS

- A. Bituminous Paint: Acid and alkali resistant type conforming to ASTM D1187.

- B. Zinc Chromate Primer: Standard zinc chromate primer, selected from manufacturers listed in this Section.
- C. Aluminum Pigmented Paint: Fibrated aluminum complying with ASTM D2824, Type IV.
- D. Apply protective coating, bituminous paint, to isolate aluminum member as required.

## **2.06 PAINT SCHEDULE**

- A. Detailed specifications for the various surfaces are shown in the Paint Schedule. If these specifications conflict with the recommendations of the manufacturer, this discrepancy shall be brought to the attention of the Owner's Representative, the Owner's Representative shall decide which method shall be followed.
- B. Refer to Paint Schedule at the end of this Section.

## **2.07 COLOR SAMPLES:**

- A. The Contractor shall furnish samples of all finishes in triplicate and obtain the approval of color match before starting work. Final colors must match exactly with the approved sample. Colors selection and quantity of different colors, as shown on Drawings, and approved by Owner's Representative.
- B. Colors: Refer to the Interior Finish Index.
  - 1. Where a different manufacturer is utilized that product identified in Interior Finish Index, color must match listed name or number.

## **2.08 MIXING AND TINTING**

- A. Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.
- B. Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- C. Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements. Do not begin application until unsatisfactory conditions have been corrected.
  - 1. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

### **3.02 SURFACES TO BE COATED**

- A. Unless noted otherwise, paint access doors, panels, registers, diffusers, light fixture trim, metal speaker covers and grilles the same color as adjacent surfaces. Paint access doors and panels in open position.
- B. Paint interiors of ducts showing through registers and grilles flat black.
- C. Paint prime coated or previously painted hinges the same as door frame to which they are attached.
- D. Finish edges of doors to match faces.
- E. Do not paint electrical device face plates or devices, sprinkler heads, smoke alarms or thermostats/covers.
- F. Unless otherwise directed, remove and spray paint metal items/products that are removable such as vents, registers, access panels, covers, louvers and diffusers. Reinstall upon completion.
  - 1. Replace broken, rusted or missing screws.

### 3.03 PREPARATION:

- A. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and items in place that are not to be painted, or provide protection prior to surface preparation and painting. Remove items if necessary for complete painting of the items and adjacent surfaces. Doors shall be removed before painting to paint bottom and top edges and then re-hung. Following completion of painting, reinstall items removed using workmen skilled in the trades involved.
- B. Clean surfaces before applying paint or surface treatments. Schedule cleaning and painting so dust and other contaminants will not fall on wet, newly painted surfaces.
- C. Provide protection for adjacent surfaces as necessary to prevent paint from coming into contact with adjacent materials not scheduled for painting.
- D. Door Hardware and Signage:
  - 1. Remove and clean.
  - 2. Reinstall items being reused in same location after refinishing.
  - 3. Leave hardware free of paint and in proper operating condition.

### 3.04 SURFACE PREPARATION:

- A. Clean and prepare surfaces to be painted in accordance with manufacturer's instructions for each particular substrate condition. Notify Architect in writing of problems anticipated using specified finish coat material with substrates primed by others.
- B. Cementitious Surfaces: Prepare concrete, concrete masonry, cement plaster and similar surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze.
  - 1. Determine alkalinity and moisture content of surfaces to be painted. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
  - 2. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
    - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
  - 3. At areas to receive epoxy paint, clean concrete with muriatic acid, wash per manufacturers recommendations.
- C. Ferrous Metals: Clean non-galvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
  - 1. Touch-up shop-applied prime coats that have been damaged, and bare areas. Wire-brush, clean with solvents, and touch-up with the same primer as the shop coat.
  - 2. At areas to receive epoxy paint, prepare steel surfaces to SSPC-SPII power tool clean.
- D. Galvanized Surfaces: Utilize SSPC-SP1 solvent cleaning and chemical wash (tri-sodium phosphate). Power wash with tri-sodium phosphate type cleaner (5% solution at 140 degrees F.) and solvent clean after rinsing and drying with a non-petroleum based solvent cleaner so that surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock, by mechanical methods.
  - 1. Touch-up shop-applied prime coats that have been damaged, and bare areas. Wire-brush clean with solvents, and touch-up with the same primer as the shop coat.
- E. Wood Surfaces:
  - 1. General:

- a. Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
  - b. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  - c. Delete subparagraphs below if these requirements are specified in other Sections.
  - d. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
  - e. When transparent finish is required, backprime with spar varnish.
  - f. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
  - g. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
- F. Previously Painted:
- 1. For any interior wood surface where the previous clear finish (not paint or enamel) is dull or worn, but not cracked or peeling to bear wood, wash the surface with a solvent to remove accumulated wax, dirt and grease. Wipe with clean cloths while surface is still wet. Sand lightly with a fine paper until smooth and remove all dust with a tack rag.
  - 2. For any interior wood surface where the previous clear finish (except floors) is badly worn, chipped, crazed or peeling, remove the old finish down to the bear wood by sanding or using paint and varnish remover. Bleach out any undesirable stains. Wash the entire surface with solvent and allow to dry. . Sand lightly with a fine paper until smooth and remove all dust with a tack rag.
  - 3. For any interior wood surface where the previous opaque finish is in good condition, clean all grease, dust and dirt from surface. Traces of wax, if any, should be removed with a solvent, followed by thorough washing using a non-sudsing detergent in hot water. Rinse thoroughly and allow to dry before finishing. Be sure all wax is removed before refinishing.
  - 4. Surfaces previously coated with gloss or semi-gloss paint or varnish shall be roughened, using abrasive paper, after cleaning with a strong washing solution such as TSP. The surface must be absolutely dry before sandpapering or repainting. Disintegrated, chalked or powdery areas should be sanded carefully and thoroughly to insure adhesion.
  - 5. Existing surfaces being repaired shall be primed before being finished in accordance with paint manufacturer's recommendation.
  - 6. If mold and mildew is found, clean area with germicidal detergent following manufacturer's printed instructions.

### **3.05 MATERIALS PREPARATION**

- A. Mix and prepare paint in accordance with manufacturer's directions.
- B. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain before using.
- C. Use only thinners approved by manufacturer, and only within recommended limits.

### **3.06 APPLICATION**

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
- B. Paint colors, surface treatments, and finishes are indicated in "schedules."
- C. The number of coats and film thickness required is the same regardless of application method. Do not apply succeeding coats until previous coat has cured. Sand between applications where required to produce a smooth, even surface. Apply additional coats when undercoats or other conditions show through final coat, until paint film is of uniform finish, color, and appearance.

- D. The term "exposed surfaces" includes areas visible when permanent or built-in items are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
- E. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
- F. Omit primer on metal surfaces that have been shop-primed, unless primer becomes worn, damaged, or more than six months old from date of delivery to job site.
- G. Paint all edges of every door to match faces, including top and bottoms.

### **3.07 MINIMUM COATING THICKNESS**

- A. Apply materials at the manufacturer's recommended spreading rate. Provide total dry film thickness of the system as recommended by the manufacturer.

### **3.08 BLOCK FILLERS:**

- A. Apply block fillers at a rate to ensure complete coverage with pores filled.

### **3.09 PRIME COATS:**

- A. Before application of finish coats, apply a prime coat as recommended by the manufacturer to material required to be painted or finished, and has not been prime coated by others.
- B. Tinting of primers will not be permitted.
- C. Re-coat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- D. Back Priming:
  - 1. All wood trim shall be back primed before installation. Spot prime all ends of trim.
    - a. Backprime and paint face and edges of plywood service panels for telephone and electrical equipment before installation to match adjacent wall surface.

### **3.10 BRUSH APPLICATION:**

- A. Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Draw neat glass lines and color breaks. Apply primers and first coats by brush unless manufacturer's instructions permit use of mechanical applicators.

### **3.11 ROLLER APPLICATION**

- A. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

### **3.12 MECHANICAL APPLICATIONS:**

- A. Mechanical methods for paint application will ONLY be permitted by written permission of the Architect. All suite entry doors must be brush applied.

### **3.13 FIELD QUALITY CONTROL**

- A. Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.
- B. Where touch-ups occur, match color and sheen of existing surface. Touch-ups must blend invisibly, or painting must be extended to nearest corner or other termination point, as acceptable to the Owner's Representative.
- C. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Owner's Representative:
  - 1. Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
  - 2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
  - 3. Damage due to touching before paint is sufficiently dry or any other contributory cause.



4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
  5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
  6. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 48".
  7. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 48".
  8. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
  9. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- D. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
  2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:
    - a. Dry Film Thickness.
    - b. Volume Solids
    - c. Content of the material actually delivered to the site as compared to the product's published label analysis
  3. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

### **3.14 CLEANING**

- A. At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
  1. Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers / strippers in accordance with the safety requirements of authorities having jurisdiction
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing, scraping, or other proper methods, using care not to scratch or damage adjacent finished surfaces.
- C. Protect work of other trades, whether to be painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- D. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations. At completion of construction activities of other trades, touch-up and restore damaged or defaced painted surfaces.

### **END OF SECTION**

**SECTION 09 96 00**  
**HIGH-PERFORMANCE COATINGS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Special coating for exterior [and] [, indoor pool area] [and] exposed ferrous metals.
  - 2. Epoxy Floor Coating
  - 3. Concrete Stain/Sealer
  - 4. This Section includes surface preparation and the application of special coating materials to items scheduled.
    - a. Surface preparation, prime and finish coats specified are in addition to shop-priming and surface treatments.
  - 5. Paint all exposed surfaces, whether or not colors are designated, except where a surface or material is indicated not to be painted or is to remain natural. Where an item or surface is not mentioned, paint the same color as similar adjacent materials or surfaces. If color or finish is not designated, the [Owner's Representative] [Architect] will select from standard colors or finishes available.
  - 6. Painting is not required on pre-finished items, operating parts, or labels.
    - a. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels, or equipment name, identification, performance rating, or nomenclature plates.
- B. Related Sections:
  - 1. Section 03 30 00 (03300) - Cast-in-Place Concrete
  - 2. Section 03 54 13 (03500) - Cementitious Decks and Underlayment
  - 3. Section 05 52 00 (05520) - Handrails and Railings
  - 4. Section 08 11 13 (08110) - Steel Doors and Frames
  - 5. Section 09 90 00 (09900) - Painting

**1.02 REFERENCES**

- A. ASTM International (ASTM) Publications:
  - 1. D16 "Standard Terminology for Paint, Related Coatings, Materials, and Applications"
- B. The Society for Protective Coatings (SSPC) Publications:
  - 1. SP - Surface Preparation Standards and Specifications
    - a. SSPC-SP 1, "Solvent Cleaning"
    - b. SSPC-SP 3 "Power Tool Cleaning"
    - c. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning"
    - d. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning"
    - e. SSPC-SP 11, "Power Tool Cleaning to Bare Metal"
- C. The Painting and Decorating Contractors of America (PDCA)
  - 1. PDCA P5-94 "Benchmark Sample Procedures for Paint and Other Decorative Coating Systems"

**1.03 DEFINITIONS:**

- A. "Special Coatings" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

**1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.

1. Product Data: Submit manufacturer's technical information, including basic materials analysis and application instructions for each coating material specified.
  - a. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
2. Color Charts: In duplicate, for all paints, stains and special coatings. Identify with numbers used on the "Finish Index" on Drawings.
3. Ferrous Metal: Provide two 4" square samples of metal surfaces for each type of color and finish. Define by steps.

#### **1.05 QUALITY ASSURANCE**

- A. Single Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer, unless noted otherwise. Use only thinners recommended by the manufacturer, and only within recommended limits.
- B. Coordination of Work: Review sections in which other coatings are provided to ensure compatibility of the total systems for various substrates.
  1. Notify the Owner's Representative of problems anticipated using the materials specified.
- C. All ferrous metal shall be inspected for conformance with these Specifications and manufacturer specifications shall be for:
  1. Surface Preparation
  2. Prime and Intermediate Coats

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to the job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with trade name and manufacturer's instructions.
  1. Product Name or Title of Material
  2. Product Description (Generic Classification or Binder Type)
  3. Manufacturer's Stock Number and Date of Manufacture
  4. Contents by Volume, for Pigment and Vehicle Constituents
  5. Thinning Instructions
  6. Application Instructions
  7. Color Name and Number
  8. VOC Content
- B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 50 degrees F. in a well-ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
  1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary precautionary measures to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing, and application of coatings.

#### **1.07 PROJECT CONDITIONS**

- A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 50 degrees F., unless otherwise permitted by manufacturer's printed instructions. High solids products require temperature range of 70-90 degrees F.
- B. Do not apply coatings in snow, rain, fog, or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 degrees F. above the dew point, or to damp or wet surfaces, unless otherwise permitted by manufacturer's printed instructions. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

#### **1.08 WASTE MANAGEMENT AND DISPOSAL**

- A. Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Obtain information on these controls from applicable government agencies having jurisdiction

- B. All waste materials shall be separated and recycled. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- C. Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

## 1.09 WARRANTY

- A. Provide a five-year material and labor warranty from the manufacturer and the applicator.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Preferred Manufacturers:
  - 1. Exterior [and Interior Pool] Exposed Ferrous Metals:
    - a. The Sherwin-Williams Company (800-321-8194)
  - 2. Epoxy Coating for Concrete Floors (Interior):
    - a. The Sherwin-Williams Company (800-321-8194)
  - 3. Concrete Stain/Sealer
    - a. The Sherwin-Williams Company (800-321-8194)
- B. Approved Manufacturers:
  - 1. Exterior [and Interior Pool] Exposed Ferrous Metals:
    - a. Tnemec Company, Inc. (800-356-3041)
  - 2. Epoxy Coating for Concrete Floors (Interior):
    - a. Euclid Chemical Co, An RPM Company (877-438-3826 or 800-321-7628)
    - b. Selby, BASF Building Systems (800-433-9517)
    - c. Dur-A-Flex, Inc. (800-253-3539)
  - 3. Concrete Stain/Sealer
    - a. "Col-R-Tone III"; Kemiko, Epmar Corporation, a Subsidiary of Quaker Chemical Corporation (562-946-8781)
    - b. Approved Substitution; L. M. Scofield (800-800-9900)
    - c. Approved Substitution; Increte Systems (800-752-4626)

### 2.02 MATERIALS

- A. Material Compatibility: Provide block fillers, primers, finish coats, and related materials that are compatible with one another and the substrates indicated under conditions of service and application as demonstrated by the manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated.
  - 1. Paint-material containers not displaying manufacturer's product identification will NOT be acceptable.
    - a. Recycled content paints and primers will not be permitted for interior or exterior application.
- C. Exterior [and] [Interior Pool] [and Ferrous Metals]: All structural steel and metal fabrications, miscellaneous metal (including Lintels), handrails, uninsulated piping, mechanical and electrical equipment at exterior (including all component parts, but not including stainless steel or prefinished aluminum):
  - 1. Shop Priming:
    - a. SSPC-S 6 Commercial Blast
    - b. Primer:
      - 1) "Series 901K-97 Tnemec-Zinc" at 3.0 mils DFT; Tnemec.
  - 2. Field Application:
    - a. SSPC-SP 3 power tool clean
    - b. Spot Prime:

- 1) "Series 901K-97, Tneme-Zinc"; Tnemec.
- c. Finish (required at exposed items only). Color as selected by Owner's Representative. Apply one coat if spray applied, two coats if brush or roller applied.
  - 1) "Series 113 (color) Tneme-Tufcoat" 5.0 - 6.0 mils DFT; Tnemec.
- D. Exterior Steel Doors and Frames (Galvanized):
  1. Factory Primer (By Door Manufacturer)
    - a. To be sanded or abraded as recommended by coating manufacturer.
  2. Tie Coat:
    - a. "Clean 'n Etch" pretreatment solution by Great Lakes Laboratories (800-888-1105).
  3. Back-prime frames and all edges with one of the following:
    - a. "Series 66 HB Epoxoline" at 2.0 mils DFT; Tnemec
    - b. "Macropoxy 646-100 B58 Series"; The Sherwin-Williams Company
  4. Finish: One coat
    - a. "Series 113 Tneme-Tufcoat" (Semi-Gloss Color) at 3.0 mils DFT; Tnemec
    - b. "Water-Based Acrolon 100 Polyurethane Series 65"; The Sherwin-Williams Company
- E. Decorative Epoxy Coating for Concrete Floors:
  1. Prepare surface as recommended by manufacturer. Use abrasive blast cleaning method if requested.
  2. Two Part Epoxy Coating:
    - a. Preferred Manufacturers:
      - 1) "ArmorSeal 650 SL/RC B58-650/B60 Hardener - Broadcast with Quartz"; The Sherwin-Williams Company (800-321-8194)
    - b. Approved Manufacturers:
      - 1) "Eucopoxy Tufcoat DBS Pigmented Resin System with Color Quartz Aggregate"; Euclid Chemical Co, An RPM Company
  3. Comply with flooring system manufacturer's recommendations for installation.
  4. Provide a minimum of two coats with total dry film thickness of nominal 20 - 25 mils, as recommended by manufacturer.
  5. Color as shown on Interior Finish Index.
- F. Clear Sealer for Concrete Floors
  1. Refer to Section 03 30 00 (03300) and Interior Finish Index.

## 2.03 COLOR SAMPLES

- A. The Contractor shall furnish samples of all finishes in triplicate and obtain the approval of color match before starting work. Final colors must match exactly with the approved sample. Colors selection and quantity of different colors, as shown on Drawings, and approved by Owner's Representative.
- B. Where a different manufacturer is utilized that product identified in Interior Finish Index, color must match listed name or number.

## EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements. Do not begin application until unsatisfactory conditions have been corrected.
- B. Start of coating work will be construed as the applicator's acceptance of surfaces within particular area.

### 3.02 PREPARATION

- A. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and items in place that are not to be painted, or provide protection prior to surface preparation and coating. Remove items, if necessary, for complete painting of the items and adjacent surfaces. Following completion of coating operation, reinstall items removed using workmen skilled in the trades involved.

### 3.03 SURFACE PREPARATION

- A. Clean and prepare surfaces to be painted in accordance with manufacturer's instructions for each particular substrate condition.
- B. Ferrous Metal: Clean ungalvanized ferrous metal surfaces that have not been shop-coated. Remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with the recommendations of the Steel Structures Painting Council.
  - 1. Blast-clean steel surfaces as recommended by the coating system manufacturer and according to the requirements of SSPC Specification SSPC-SP 10.
- C. Galvanized Steel/Non Ferrous Metals: Utilize SSPC Specification SSPC-SP 1 solvent cleaning and chemical power wash (tri-sodium phosphate) to remove solvent and non-solvent soluble sealers and other substrate contaminants.
  - 1. Touch-up shop-applied prime coats that have been damaged and bare areas. Wire-brush, solvent clean, and touch-up with the same primer as the shop coat.
- D. Material Preparation: Carefully mix and prepare materials according to the coating manufacturer's directions.
  - 1. Maintain containers used in mixing and application of coatings according to the manufacturer's directions.
  - 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain the coating material before using.

### 3.04 APPLICATION

- A. General: Apply special coatings by brush, roller, spray, squeegee, or other applicators according to the manufacturer's directions. Use brushes best suited for the material being applied. Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  - 1. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
  - 2. Provide finish coats compatible with the primers used.
- B. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Where sanding is required, according to the manufacturer's directions, sand between applications to produce a smooth, even surface.
- C. The term "exposed surfaces" includes areas visible when permanent or built-in. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  - 1. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces.
  - 2. Coat the back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- D. Minimum Coating Thickness: Apply each material no thinner than the manufacturer's recommended spreading rate. Provide total dry film thickness (DFT) of the entire system as recommended by the manufacturer.
- E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to the material required to be coated or finished that has not been prime-coated by others.
  - 1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.
- F. Brush Application: Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

1. Apply primers and first coats by brush unless the manufacturer's instructions permit using mechanical applicators.
- G. Mechanical Applications: Use mechanical methods to apply coating when permitted by the manufacturer's recommendations and governing regulations, only when approved by Architect.
  1. Wherever using spray application, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of two coats in one pass, unless recommended by the manufacturer.
- H. All field connections such as bolts, nuts, and other fasteners shall be totally encapsulated with special coating system to match adjacent material.

### **3.05 FIELD QUALITY CONTROL**

- A. Applicator to maintain accurate records of the application and provide copies of the records to the manufacturer, if requested.
  1. Minimum information required in the records:
    - a. Daily temperatures - morning and evening
    - b. Weather conditions
    - c. Total area applied daily
    - d. Amount of materials used daily
    - e. Computed square foot coverage rate
- B. Manufacturer's written instructions will be kept at job site. Before application begins, all personnel involved will read these instructions.

### **3.06 COMPLETED WORK**

- A. Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

### **3.07 FIELD QUALITY CONTROL**

- A. The Owner reserves the right to engage the services of an independent testing laboratory to sample paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.
- B. The testing laboratory will perform appropriate tests as required by the Owner.
- C. If tests shown that material being used does not comply with specified requirements, the Contractor may be directed to stop painting and remove non-complying paint, pay for testing, repaint surfaces coated with rejected paint, remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

### **3.08 CLEAN-UP**

- A. At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing, scraping, or other proper methods, using care not to scratch or damage adjacent finished surfaces.
- C. Protect work of other trades, whether to be painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Owner's Representative.
- D. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
  1. At completion of construction activities of other trades, touch-up and restore damaged or defaced painted surfaces.

**END OF SECTION**

## SECTION 10 14 00

### SIGNAGE

#### GENERAL

##### 1.01 SUMMARY

A. Section Includes:

1. Interior and Exterior Graphic Plaques, Characters and Accessories.
  - a. [Furnished and Installed by Owner:] [Furnished by Owner, installed by Contractor:]
    - 1) Directional Signage
    - 2) Identification Signage
    - 3) Projection Mounted Signage
    - 4) Stair and Elevator Signage
    - 5) Informational Signage
    - 6) Letters and Graphics
    - 7) Parking Lot Signage
    - 8) Key Card Signage
    - 9) Porte Cochere Signage
    - 10) Guest Room Signage
    - 11) Exercise Room Signage
    - 12) Pool Signage
    - 13) Fire Pit Emergency Shutoff Signage
    - 14) Fire Pit Warning Plaque Signage
2. Exterior Signs:
  - a. [Furnished and Installed by Owner:] [Furnished by Owner, installed by Contractor:]
    - 1) Channel Letter Signs
    - 2) Single-Faced, Wall Mounted Signs
    - 3) Monument Signs
    - 4) Pylon Signs
3. Mounting Devices and Fittings.
4. Preparation of camera-ready artwork needed to produce the complete graphics package, unless otherwise noted.

B. Related Sections:

1. Sign Manual - Interior Graphics Package
2. Sign Manual - Exterior Graphics Package
3. Section 10 31 00 - Manufactured Fireplaces: For Emergency Shut Off and Warning Plaque signage installed at Fire Pit
4. Section 14 21 23 - Electric Traction Passenger Elevators: For code required elevator signage.
5. Section 14 24 23 - Hydraulic Passenger Elevators: For code required elevator signage.
6. Section 26 51 00 - Interior Lighting: For Exit Lighting.
7. Division 26 Sections: For electrical service and connections for illuminated signs.

##### 1.02 REFERENCES

- A. American National Standards Institute, Inc.(ANSI) Publications:
1. A117.1 "American National Standard for Buildings and Facilities Providing Accessibility and Usability for Physically Handicapped People"
- B. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- C. ASTM International (ASTM) Publications:
1. B117 "Standard Practice for Operating Salt Spray (Fog) Apparatus"
  2. D1735 "Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus"
- D. American Welding Society (AWS)



### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. A copy of the manufacturer's printed installation manual shall accompany Bid for review and approval by the Owner's Representative.
  - 2. Shop Drawings showing sign layout, lettering style, materials, and other pertinent information.
    - a. Post and panel/pylon signage: Include plans, elevations, sections, details, and attachments to other work.
    - b. Show locations of electrical service connections.

### 1.04 QUALITY ASSURANCE

- A. Graphic signs, including materials, fabrication, mounting and installation, shall conform to state and local code regulations and requirements.
- B. All items shall utilize the highest standards of professional workmanship and practices.

### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of materials comprising the complete graphics package. Store materials upon approval of Owner. Take precautions to protect materials and be responsible for same until installed, inspected and accepted in writing by Owner.

### 1.06 PROJECT CONDITIONS

- A. Coordinate work with all trades affected by Contractor's work and be fully cognizant of their requirements as pertaining to Contractor's work.

### 1.07 WARRANTIES

- A. Special Warranty: All materials, finishes and workmanship shall be warranted for a period of two (2) years after final acceptance of the work. If during the warranty period, any defects or faulty materials are found, the Contractor shall immediately proceed at his own expense to replace and/or repair same at not cost to Owner.

## PRODUCTS

### 2.01 INTERIOR SIGNAGE MANUFACTURER/FABRICATOR

- A. Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Graphic Systems Inc. / Identity Group; (316-267-4171)
    - a. Contact: Kerri Vogel (316-267-4171 ext 241); email [kerri.vogel@identitygroup.com](mailto:kerri.vogel@identitygroup.com)
  - 2. Cornelius Brand Signage, a Forms + Surfaces Company (800-553-7722)
    - a. Contact: Casey Frisco (412-282-5332); email [casey.frisco@forms-surfaces.com](mailto:casey.frisco@forms-surfaces.com)
  - 3. HOTELSIGNS.com; (888-273-8726)
    - a. Contact: Crystal Simpson (888-273-8726); email [crystalsimpson@hotelsigns.com](mailto:crystalsimpson@hotelsigns.com)
    - b. Contact: Kristin Alexin (888-273-8726); email [kristinalalexin@hotelsigns.com](mailto:kristinalalexin@hotelsigns.com)

### 2.02 MATERIALS - INTERIOR SIGNAGE

- A. Basis of Design: Refer to "Sign Manual - Interior Graphics Package" for sign types, designs, and graphic information.
- B. Acrylic: Produced by Rohm and Haas or approved substitution. Acrylic shall be cut straight and true, free of saw marks, burrs, scratches or other imperfections.
- C. Vinyl: Pressure sensitive adhesive backed vinyl with integral color as manufactured by one of the following:
  - 1. Manufacturers:

- a. None
- 2. Approved Manufacturers:
  - a. 3M (888-364-3577)
  - b. Approved substitution
- D. Polycarbonate Sheet: Manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating.
- E. Finishes:
  - 1. Signs: Produced by photographic silk-screen stencils unless otherwise noted. Hand-cut, frisketed, or die-cut images will not be accepted.
  - 2. Silk-screening inks: As manufactured by one of the following:
    - a. Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) Naz-Dar Company (800-767-9942)
      - 2) Approved substitution
  - 3. Ink and paint: Mixed in sufficient quantities to assure consistent coloration throughout project.
- F. Adhesive: Colorless adhesive used in strict accordance with manufacturer's recommendations for conformance to the manufacturer's product warranty, as manufactured by one of the following:
  - 1. Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. General Electric
    - b. Dow Corning, Inc. (800-248-2481)
    - c. Approved substitution
- G. Fasteners: Non-corrosive, physically compatible with material fastened. Size, shape and type as recommended by the fabricator. Owner maintains the right to review fastening techniques to assure aesthetic conformance to design drawings.

## **2.03 EXTERIOR BUILDING, MONUMENT AND PYLON SIGNS MANUFACTURER/FABRICATOR**

- A. Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Chandler Signs (214-902-2000)
    - a. Dallas, TX
    - b. Contact: Doug Shirley ([dshirley@chandlersigns.com](mailto:dshirley@chandlersigns.com))
  - 2. Persona Inc. (800-843-9888)
    - a. Watertown, SD
    - b. Contact: Mike Peterson ([mpeterson@personasigns.com](mailto:mpeterson@personasigns.com))
  - 3. Transworld Signs (888-808-8030)
    - a. US or Canadian Sales Contact: Scott Gabrisch (281-812-4987) ([sgabrisch@transworldsigns.com](mailto:sgabrisch@transworldsigns.com))
  - 4. Coast Sign Inc. (714-520-9144)
    - a. Anaheim, CA
    - b. Contact: Fred Siavoshi ([fred.siavoshi@coastsign.com](mailto:fred.siavoshi@coastsign.com))
  - 5. Cummings Signs (800-489-7446)
    - a. Nashville, TN
    - b. Contact: Betsy Ewart ([betsy.ewart@cummingsigns.com](mailto:betsy.ewart@cummingsigns.com))
  - 6. Entera (800-868-0284)
    - a. Panama City, FL
    - b. Contact: John Collins (850-392-0823) ([jcollins@enterabranding.com](mailto:jcollins@enterabranding.com))
  - 7. Montreal Neon Signs (534-955-3333)

- a. Laval (Quebec), Canada
- b. Contact: Mike Mele ([mikem@msignagesolutions.com](mailto:mikem@msignagesolutions.com))

## 2.04 MATERIALS - EXTERIOR SIGNAGE

- A. Basis of Design: Refer to "Sign Manual - Exterior Graphics Package" for sign types, designs, and graphic information.
- B. Standard approved signage. Coordinate mounting with building construction and site layout.

## 2.05 EXTERIOR ADA PARKING SIGNS

- A. Provide exterior ADA Parking signs where indicated on the Drawings.
- B. Steel Posts: Type II round post shall be manufactured from cold rolled steel, welded and have a minimum yield strength of 50,000 psi given corrosion protection by an exterior triple coating consisting on zinc-applied before of after welding, chromate conversion and a clear polymer overcoat.
  1. The inside surface shall be given corrosion protection. The internal coating shall be applied before or after welding and shall protect the metal from corrosion when subjected to the following:

	<u>ASTM</u>	<u>Exposure Time</u>	<u>End Point</u>
Salt spray (fog)	B117	300 hours	5% Red Rust

2. The external coating shall meet the following requirements.

	<u>ASTM</u>	<u>Exposure Time</u>	<u>End Point</u>
Salt spray (fog)	B117	12,000 hours	5% Red Rust
Water (fog)	D1735	500 hours	1st Red Rust

3. Each steel post shall have an ornamental top of galvanized steel or aluminum alloy designed to fit snugly over the post to exclude moisture. The top shall have a method of securing it to the post to prevent easy removal.
- C. Drive Posts: Drive posts shall meet Local DOT requirements, post size No. 3.
- D. Sign Type: Accessible Parking: Shall meet Local DOT requirements
- E. Mixes:
  1. Concrete for Foundations: meet Local DOT requirements.
  2. Quantity: Provide ADA signs in locations as shown on the Drawings.

## EXECUTION

### 3.01 PREPARATION

- A. Examination:
  1. Examine areas for conditions detrimental to completion of the delivery and installation work. Report findings to the [Architect][Owner's Representative] immediately. Do not proceed with work until unsatisfactory conditions have been corrected or until advised in writing by the Owner.
  2. Starting work constitutes acceptance of conditions under which the work is to be performed. After such acceptance Contractor shall, at his own expense, be responsible for correcting all unsatisfactory and defective work resulting from such unsatisfactory conditions.

### 3.02 INSTALLATION

- A. Perform all cutting and fitting necessary for installation and completion of the work while accommodating the work of other trades. Immediately repair damage to existing surfaces or finishes caused by work of this Contractor at no cost to Owner.
- B. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer's instructions

- C. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
  - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- D. Interior Signage:
  - 1. Install at locations as directed by Owner's Representative.
  - 2. Install in strict accordance to manufacturer's recommended procedures.
  - 3. Signs indicated to be door mounted shall use a combination of vinyl tape and silastic adhesive for a permanent bond.
  - 4. Signs indicated to be installed on the wall adjacent to the latch side of the door shall have a mounting height of 60" above finished floor to centerline of sign. Mounting location shall be so that a person may approach within 3" of signage without encountering protruding objects or standing within the swing of a door.
  - 5. Insure level installation.
- E. Exterior Signage:
  - 1. Install exterior signage and cabinet as indicated on Drawings.
  - 2. Install Accessible Parking signs as indicated on the Drawings. Locations and heights to meet ADA.

### **3.03 CLEANING AND PROTECTION**

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.
- B. Provide cleanup and removal of debris resulting from the installation work.

#### **END OF SECTION**

**SECTION 10 21 13**  
**TOILET COMPARTMENTS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Extent of toilet partitions is indicated on Drawings.
  - 2. Styles of toilet compartments include:
    - a. Laminate Finished, Floor-Anchored, Overhead Braced
  - 3. Styles of Screens include:
    - a. Laminate Finished, Floor-Anchored
- B. Related Sections:
  - 1. Section 09 21 16 (09255) - Gypsum Board Assemblies
  - 2. Section 09 30 00 (09310) - Tiling
  - 3. Section 10 28 00 (10800) - Toilet, Bath, and Laundry Accessories

**1.02 REFERENCES**

- A. Americans with Disabilities Act (ADA) II Public Accommodations
  - 1. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- B. ASTM International (ASTM) Publications:
  - 1. A167 "Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip"

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.
  - 2. Shop Drawings: Submit shop drawings for fabrication and erection of toilet partition assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

**1.04 QUALITY ASSURANCE**

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking field measurements before fabrication might delay work.
- B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

**PRODUCTS**

**2.01 MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Accurate Partitions Corp. (708-442-6800)
    - a. Toilet Compartments: "Floor Anchored/Overhead Braced Mounting Style"
    - b. Urinal Screens: Floor mounted with post supports.
  - 2. Knickerbocker Partition Corp. (516-546-0550)
    - a. Toilet Comp: "Metropolitan"
    - b. Urinal Screens: Floor mounted with post supports.

3. Metpar Corporation (888-638-7271)
  - a. Toilet Compartments: "Corinthian FP-500"
  - b. Urinal Screens: Type "PF"
4. Flush-Metal Partition Corporation (718-784-3380)
  - a. Toilet Compartments: "Flushite"
  - b. Urinal Screens: "PS-Post Supported"
5. Bobrick Washroom Equipment (818-764-1000)
  - a. Toilet Compartments: No. 1042 Series, Overhead Braced
  - b. Urinal Screens: No. 1043 Designer Series: 1541 Classic Series, Floor-Anchored.
6. Global Partitions (516-586-3330)
  - a. Toilet Compartments: "Floor Anchored/Overhead Braced"
  - b. Urinal Screens: Floor mounted with Post Support
7. Hadrian Manufacturing, Inc. (800-536-1469)
  - a. Toilet Compartments: "Headrail Braced"
  - b. Urinal Screens: Floor mounted with Post Support

## 2.02 MATERIALS

- A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.
- B. Concealed Anchorage Reinforcement: Minimum 12 gauge galvanized steel sheet.
- C. Concealed Tapping Reinforcement: Minimum 14 gauge galvanized steel sheet.
- D. Pilaster Shoes: ASTM A167, Type 304 stainless steel, not less than 3" high, 20-gauge, finished to match hardware.
- E. Stirrup Brackets: Manufacturer's standard design for attaching panels to walls and pilasters, either chromium-plated non-ferrous cast alloy ("Zamac") or anodized aluminum.
- F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of stainless steel.
  1. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match hardware, with theft-resistant type heads and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.
- G. Overhead Bracing: Continuous extruded aluminum, antigrip profile, with clear anodized finish.

## 2.03 FABRICATION

- A. General: Furnish standard doors, panels, and pilasters fabricated for partition system, unless otherwise indicated. Furnish units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated. Fabricate to fit dimensions shown on Drawings.
- B. Door Dimensions: Unless otherwise indicated, furnish 24" wide in swinging doors for standard toilet compartments and 36" wide (32" clear opening) outswinging doors at stalls equipped for compartments shown as wheelchair accessible. [Provide 34" (32" clear opening) wide out-swinging doors for compartments shown as ambulatory compartments.]
- C. Overhead-Braced Compartments: Furnish galvanized steel supports and leveling bolts at pilasters as recommended by manufacturer to suit floor conditions. Make provisions for setting and securing continuous, extruded, aluminum, antigrip, overhead bracing at top of each pilaster.
  1. Furnish galvanized steel anchorage devices complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters to permit structural connection at floor. Provide shoe at each pilaster to conceal anchorage.
- D. Hardware: Furnish hardware for each compartment in partition system, as follows:
  1. Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type, to suit manufacturer's standards.

2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit, designed for emergency access, with combination rubber-faced door strike and keeper.
3. Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.
4. Door Pull: Manufacturer's standard unit for out-swing doors. Provide pulls on both faces of handicap compartment doors. Design shall be in conformance with ADA requirements.

## **2.04 FINISHES**

- A. Color: As indicated in Interior Finish Index.

## **EXECUTION**

### **3.01 INSTALLATION**

- A. General: Comply with manufacturer's recommended procedures and installation sequence. Install partitions rigid, straight, plumb, and level. Provide clearances of not more than 1/2" between pilasters and panels, and not more than 1" between panels and walls. Secure panels to walls with not less than two stirrup brackets attached near top and bottom of panel. Locate wall brackets so that holes for wall anchorages occur in masonry or tile joints. Secure panels to pilasters with not less than two stirrup brackets located to align with stirrup brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices.
- B. Floor Supported Partitions and Screens: Set pilaster units with anchorages having not less than 2" penetration into structural floor, unless otherwise recommended by partition manufacturer. Level, plumb, and tighten installation with devices furnished. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.
- C. Overhead Braced Compartments: Secure overhead brace to each pilaster with not less than two stirrup brackets. Hang doors and adjust so that top of doors are parallel with overhead brace when doors are in closed position.
- D. Screens: Attach with anchoring devices as recommended by manufacturer to suit supporting structure set units to provide support and to resist lateral impact.

### **3.02 ADJUST AND CLEAN**

- A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on inswinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors (and entrance swing doors) to return to fully closed position.
- B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

**END OF SECTION**

**SECTION 10 26 00**  
**WALL AND DOOR PROTECTION**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Wall Protection Corner Guards
- B. Related Sections:

**1.02 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Provide manufacturer's technical data, installation instructions, setting drawings, templates, instructions, and directions for installation of anchorage devices in other work.

**1.03 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver guards to site until rooms in which they are to be installed are ready to receive them.
- B. Store packages to prevent physical damage or wetting.
- C. Pack all parts individually in a manner to protect finish.
- D. Maintain protective covers on all units until final clean-up.

**1.04 WARRANTY**

- A. Work of this Section shall be jointly warrantied by the manufacturer and the installer for a period of one year after final payment. Any material or workmanship that is judged defective during this period shall be replaced at no cost to the Owner.

**PRODUCTS**

**2.01 MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. IPC Door and Wall Protection Systems, Inpro Corp. (800-543-1729)
- B. Approved Manufacturers:
  - 1. Grand Entrance, A Division of Construction Specialties, Inc. (888-424-6287)
  - 2. Balco, Inc. (800-628-0449)
  - 3. Korogard Wall Protection Systems, a Division of RJF International Corporation (800-628-0449)
  - 4. Fry Reglet Corporation (888-237-9773)

**2.02 WALL PROTECTION CORNER GUARDS**

- A. Surface mounted corner guards of various materials. Provide backing in walls for mounting.
- B. Corner Guards: "Rigid extruded PVC, 90 degree type"; adhesive applied.
  - 1. Size:
    - a. Guest Rooms, and other locations as noted on the Drawings:  $\frac{3}{4}$ " x  $\frac{3}{4}$ ". Thickness: 0.080"
    - b. Corridors: 1-1/2" x 1-1/2". Thickness: 0.080".
    - c. Height to be from top of resilient or carpet base to underside of ceiling with no gaps top or bottom.
    - d. Where ceiling heights are greater than 8'-0", provide corner guards in one piece, no joints or seams will be permitted.
  - 2. Color: Refer to Interior Finish Index.
  - 3. Attachment: Adhesive cement as recommended by manufacturer.
    - a. Self-Adhesive tape application not permitted.



- C. Stainless Steel Corner Guards "Model No. 180", 90 degree type with 1/8" radius, adhesive applied, by IPC or approved substitution by listed manufacturer.
  - 1. Locations: [Laundry] [and] [Housekeeping] [As shown on Interior Finish Index]
  - 2. Size: 3-1/2" x 3-1/2"
    - a. Height to be from top of base to underside of ceiling.
  - 3. Finish: No. 4, brushed finish
  - 4. Attachment: Adhesive cement as recommended by manufacturer.

### **2.03 SPECIALTY CORNER GUARDS**

- A. Protruding Edge Profile: Fry Reglet Model No. DRMPCR-100-100, aluminum reveal corner guard 1' X 1", clear anodized finish with 1/4" x 1/4" accent feature at reveals.

### **2.04 SEE DRAWINGS FOR LOCATIONS.**

### **2.05 ACCESSORIES**

- A. Provide all appropriate mounting systems including all screws, bolts, brackets, end caps, and base plates as required for complete installation.

## **EXECUTION**

### **3.01 INSTALLATION**

- A. Attach retainers to wall with appropriate anchorage devices furnished by manufacturer. Snap-lock covers onto retainers after paint or wallcoverings have been applied.
- B. Install guards, accessories, and items in accordance with manufacturer's printed instructions.
- C. Use concealed fastenings wherever possible.
- D. Install true, plumb, and level, securely and rigidly anchored to substrate in accordance with manufacturer's instructions for each item and each type of substrate construction.
  - 1. Attach with manufacturer's recommended adhesive.

**END OF SECTION**

**SECTION 10 28 00**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Toilet Accessories
  - 2. Bath Accessories
  - 3. Attachment hardware
- B. Related Sections:
  - 1. Section 05 50 00 (05500) - Metal Fabrications
  - 2. Section 06 10 00 (06100) - Rough Carpentry: Blocking
  - 3. Section 08 80 00 (08800) - Glazing: Unframed mirrors, tub and shower glass
  - 4. Section 09 30 00 (09310) - Tiling: Coordinate installation of accessories
  - 5. Section 10 21 13 (10165) - Toilet Compartments: Coordinate installation of accessories
  - 6. Section 10 28 19.21 - Tub and Shower Doors: Coordinate installation

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. A167 - "Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip"
  - 2. A666 "Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar"
- B. American National Standards Institute (ANSI)
  - 1. ICC/ANSI A117.1-2009 , "Accessible and Useable Buildings and Facilities"
- C. Americans with Disabilities Act (ADA) II Public Accommodations

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this project.

**1.04 QUALITY ASSURANCE**

- A. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same area.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
- B. Store packages to prevent physical damage or wetting.
- C. Pack accessories individually in a manner to protect accessory and its finish.
- D. Maintain protective covers on all units until final clean-up.
- E. Protection: Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this Section.

**1.06 WARRANTY**

- A. Work of this Section shall be jointly warrantied by the manufacturer and the installer for a period of one year after final payment. Any material or workmanship that is judged defective during this period shall be replaced at no cost to the Owner.

## PRODUCTS

### 2.01 DISTRIBUTORS

- A. Avendra, LLC Preferred Distributor:
  - 1. Contract Hardware, Inc. (800-266-3418)
    - a. Contact: Mark Tew
  - 2. Home Depot Supply
    - a. Contact: Rajan Batra (703-404-4567)

### 2.02 MANUFACTURERS

- A. See Toilet & Bath Accessory Matrix for list of which Manufacturer's are approved for use on a specific item.
- B. Preferred Manufacturers:
  - 1. Franklin Brass, Liberty Hardware Manufacturing Corp., A Masco Company (800-421-3375)
  - 2. Winglts LLC (877-894-6448)
- C. Approved Manufacturers:
  - 1. American Specialties, Inc. (ASI) (914-476-9000)
  - 2. Bobrick Washroom Equipment, Inc. (818-503-1630)
  - 3. Gamco, A Bobrick Company (800-421-3375)
  - 4. Hafele America Co. (HEWI) (336-889-2322)
  - 5. Preferred Bath Accessories LLC (336-575-0080)
  - 6. Mincey Marble Manufacturing Co. (800-533-1806)
  - 7. Shower Solutions USA, Inc. (407-314-2176)
  - 8. Delta Faucet Company (800-345-3358)
  - 9. Granite Tech, Inc. (610-274-1494)
  - 10. Symmons Industries, Inc. (800-796-6667)

### 2.03 MATERIALS - TOILET ACCESSORIES

- A. 18-8 (Type 302) stainless steel alloy of at least 22 gauge in all elements of cabinet work. Unless shown otherwise, all exposed stainless steel to have a #4 Satin finish or Satin chrome finish where applicable with all elements of a unit to have brushing in one direction.
- B. Exposed surfaces to be protected with a factory applied PVC film to be left in place until final clean-up.
- C. Mirrors to be 1/4" polished plate glass with 10-year guarantee against silver spoilage.
- D. Stainless steel tubing: 18 ga., Type 304, seamless welded.
- E. Fasteners, screws, and bolts: Hot dip galvanized. Expansion shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component substrate.
- F. Adhesive: Epoxy type contact cement.

### 2.04 FINISHES

- A. Guest Rooms: Refer to Toilet & Bath Accessory Matrix for Finishes.
- B. Employee and Public Toilet Rooms: Refer to Toilet & Bath Accessory Matrix for Finishes.
- C. Exposed heads of fasteners shall match finish of accessory.

### 2.05 FABRICATION - TOILET ACCESSORIES

- A. Provide steel anchor plates and anchor components for installation on building finishes.
- B. Form surfaces flat without distortion. Maintain flat surface without scratches or dents.
- C. Back paint components where contact is made with building finishes to prevent electrolysis.
- D. Hot dip galvanize ferrous metal anchors and fastening devices.
- E. Shop assemble components and package complete with anchors and fittings.

## **EXECUTION**

### **3.01 PREPARATION**

- A. Deliver inserts and rough-in frames to job site and in appropriate time for building-in. Provide templates and rough-in measurements as required.
- B. Before starting work, notify Owner's Representative in writing of any conflicts detrimental to installation or operation of units.
- C. Verify with Owner's Representative exact location of accessories.

### **3.02 INSTALLATION**

- A. Install fixtures, accessories, and items in accordance with manufacturer's printed instructions.
- B. Use concealed fastenings wherever possible.
- C. Install true, plumb, and level, securely and rigidly anchored to substrate in accordance with manufacturer's instructions for each item and each type of substrate construction.
  - 1. Wood blocking shall be provided at grab bars and fold down shower seats, and as shown on Drawings.
  - 2. Strap metal may be used for all other areas, as approved by Owner's Representative, unless indicated otherwise.
- D. Fasteners for all accessory mounting to be theft-resistant.

### **3.03 ACCESSORY SCHEDULE**

**END OF SECTION**

**SECTION 10 28 19**  
**TUB AND SHOWER ENCLOSURES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Frameless Shower Door With Fixed Glass Panel
  - 2. Attachment hardware
- B. Related Sections:
  - 1. Section 05 50 00 (05500) - Metal Fabrications
  - 2. Section 06 10 00 (06100) - Rough Carpentry: Blocking
  - 3. Section 06 61 13 (06610) - Cultured Marble Fabrications
  - 4. Section 08 80 00 (08800) - Glazing: Unframed mirrors, tub and shower glass
  - 5. Section 09 30 00 (09310) - Tiling: Coordinate installation of accessories
  - 6. Section 10 21 13 (10165) - Toilet Compartments: Coordinate installation of accessories
  - 7. Section 10 28 00 (10800) - Toilet Bath And Laundry Accessories

**1.02 REFERENCES**

- A. ASTM International Publications:
  - 1. A167 - "Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip"
  - 2. A666 "Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar"
- B. American National Standards Institute (ANSI)
  - 1. ICC/ANSI A117.1-2009 , "Accessible and Useable Buildings and Facilities"
- C. Americans with Disabilities Act (ADA) II Public Accommodations

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this project.
  - 2. Shop Drawings: For tub and shower doors and enclosures.

**1.04 QUALITY ASSURANCE**

- A. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same area.
- B. Coordinate with Tub and Shower Surrounds specified in Section 06 61 13 "Cultured Marble Fabrications".
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
  - 1. Build mockup of tub and shower doors and enclosure as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver components to site until rooms in which they are to be installed are ready to receive them.

- B. Store all materials to prevent physical damage or wetting.
- C. Maintain protective covers on all units until final clean-up.
- D. Protection: Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this Section.

## 1.06 WARRANTY

- A. Work of this Section shall be jointly warranted by the manufacturer and the installer for a period of one year after final payment. Any material or workmanship that is judged defective during this period shall be replaced at no cost to the Owner.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Continental Group (614-679-1201)
  - 2. ProjectStone by Belstone (877-667-8663)
  - 3. Mincey Marble Manufacturing Co. (800-533-1806)

### 2.02 MATERIALS

- A. 18-8 (Type 302) stainless steel alloy of at least 22 gauge. Unless shown otherwise, all exposed stainless steel to have a #4 Satin finish or Satin chrome finish where applicable with all elements of a unit to have brushing in one direction.
- B. Exposed surfaces to be protected with a factory applied PVC film to be left in place until final clean-up.
- C. Stainless steel tubing: 18 ga., Type 304, seamless welded.
- D. Glazing: Safety glazing materials complying with 16 CFR 1201, Category II, with permanently etched identification acceptable to authorities having jurisdiction.
- E. Provide frameless glass panels with mounting and operating hardware of types and sizes required to support imposed loads.
- F. Fasteners, screws, and bolts: Hot dip galvanized. Expansion shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component substrate.
- G. Adhesive: Epoxy type contact cement.
- H. Preferred Manufacturers:
  - 1. None
- I. Approved Manufacturers:
  - 1. C.R. Laurence Company (CRL)
  - 2. Complete System: "Model BB81770"; Continental Group
  - 3. Complete System: "Model Belstone 7260/85 SD"; ProjectStone by Belstone
- J. Materials:
  - 1. Glass Fixed Panel:
    - a. Clear, tempered, polished edges.
    - b. Size: Refer to Drawings for width and height.
  - 2. U Channels for Fixed Panel: (One side of glass panel):
    - a. Finish: Polished Chrome (Bright Anodized)
  - 3. Ceiling Clamps and Floor Clips::
    - a. Finish: Polished Stainless Steel
  - 4. Hinges (C): Glass to Wall 90° inward and outward: Self-centering with reversible pivot pin. Adjustable for glass thickness from 3/8" to 1/2".
    - a. Finish: Polished Chrome

5. Back to Back Pull Handles: Tubular brass pull handle, 3/4" diameter, 1.5 mil thick, standard plastic washers included to protect against glass-to-metal contact.
  - a. Pull Handles: 6-1/4" center-to-center hole spacing.
  - b. Finish: Polished Chrome
  - c. "Model Number SQ8X8CH"; C.R. Laurence Company
  - d. "Model BH817800"; Continental Group
  - e. ["Model 7260/85DH"] ["7260/85DH OPT"]"; ProjectStone by Belstone
6. Door Wipe and Drip Rail: Clear co-extruded polycarbonate bottom wipe with 45° drip rail to shed water back into shower. Dual wipes on bottom to create water tight seal. Wipe to snap onto bottom of door.
7. Polycarbonate Strike: Clear polycarbonate "h" jamb:
8. Door Pull Bumper: 3/4" diameter, 1/4" thick clear vinyl shower door pull bumper. Provide with 1-1/2" screw to secure to blocking.
9. Fasteners: All fasteners to be by the manufacturer.
10. Adhesives: Type as per manufacturer's recommendations.
11. Sealant: Silicone type as per manufacturer's recommendations
12. Components:

FRAMELESS SHOWER DOOR WITH ONE FIXED GLASS PANEL MARK NO. 460			ProjectStone by Belstone	Mincey Marble Manuf Co.	Continental Group	
	Part	Size	Model No.	Model No.	Model No.	
a.	Door		7260/85D (5/16")	Approved substitution	BB817700 (3/8")	
b.	Fixed Panel		7260/85SI (5/16")	Approved substitution	BB817700 (3/8")	
c.	U Channels	3/4" or 1" deep	7260/85UC 75	Approved substitution	BH817704	
d.	Hinges		7260/85WH	Approved substitution	BH808500	
e.	Back to Back Pull Handles	See above for approved products.				
f.	Door Wipe and Drip Rail		7260/85DS	Approved substitution	Approved substitution	
g.	Polycarbonate Strike		7260/85SJ	Approved substitution	Approved substitution	
h.	Door Pull Bumper:					
i.	Shower Surround	Refer to Section 06 61 13, Interior Finish Index and the Tub and Shower Surround Product Manual				
j.	Glass Mounted Robe Hook	Refer to Toilet & Bath Accessory Matrix Mark Number 280				
k.	Shower Pan	Refer to Toilet & Bath Accessory Matrix				
l.	Toilet and Bath Accessories	Refer to Section 10 28 00.				

## 2.03 FINISHES

- A. Exposed heads of fasteners shall match finish of accessory.

## 2.04 FABRICATION -

- A. Provide steel anchor plates and anchor components for installation on building finishes.

- B. Form surfaces flat without distortion. Maintain flat surface without scratches or dents.
- C. Back paint components where contact is made with building finishes to prevent electrolysis.
- D. Hot dip galvanize ferrous metal anchors and fastening devices.
- E. Shop assemble components and package complete with anchors and fittings.

## **EXECUTION**

### **3.01 PREPARATION**

- A. Deliver inserts and rough-in frames to job site and in appropriate time for building-in. Provide templates and rough-in measurements as required.
- B. Before starting work, notify Owner's Representative in writing of any conflicts detrimental to installation or operation of units.
- C. Set units level, plumb, and true to line, without warp or rack of frames and panels, and anchor securely in place.
- D. Fasten components securely in place, with provisions for thermal movement. Install with concealed fasteners unless otherwise indicated.
- E. Install components to drain and return water to tub or shower.
- F. Install doors to produce smooth operation and tight fit at contact points.
- G. Verify with Owner's Representative exact location of accessories.

### **3.02 INSTALLATION**

- A. Install all enclosures in accordance with manufacturer's printed instructions.
- B. Use concealed fastenings wherever possible.
- C. Install true, plumb, and level, securely and rigidly anchored to substrate in accordance with manufacturer's instructions for each item and each type of substrate construction.
  - 1. Wood blocking shall be provided at grab bars and fold down shower seats, and as shown on Drawings.

## **END OF SECTION**



**SECTION 10 44 00**  
**FIRE PROTECTION SPECIALTIES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Fire Extinguishers and Brackets
  - 2. Fire Extinguisher Cabinets
  - 3. Fire Hose and Valve Cabinet
  - 4. Accessories
- B. Related Sections:

**1.02 REFERENCES**

- A. National Fire Protection Association (NFPA) Publications:
  - 1. 10 "Portable Fire Extinguishers"
- B. Underwriter's Laboratories, Inc. (UL) Standards:
  - 1. 4A-"60BC classification"

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit product data which shall include physical dimensions, operational features, color and finish, anchorage details, rough-in measurements, location, and details.
  - 2. Submit manufacturer's installation instructions.

**1.04 QUALITY ASSURANCE**

- A. Conform to NFPA 10 requirements for extinguishers.

**1.05 OPERATION AND MAINTENANCE DATA**

- A. Do not install extinguishers when ambient temperatures may cause freezing.

**PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. Larsen's Manufacturing Company (800-527-7367).
  - 2. JL Industries, an Activar Inc. Company (800-554-6077).
  - 3. Modern Metal Products, a Division of Technico, Inc. (800-435-5544)

**2.02 EXTINGUISHERS:**

- A. Multi-Purpose, Dry-Chemical Type: Steel Tank, pressurized, including hose and nozzle; 10-pound, ABC classification, UL 4A/60BC.

**2.03 BRACKET:**

- A. Furnish wall mount bracket where shown on Drawings complete with mounting hardware.

**2.04 CABINETS:**

- A. Items specified below are by Larsen's Manufacturing Co. Equivalent products by listed manufacturer will be acceptable.
  - 1. Wall mounted on Bracket (FE): "MP10" Extinguisher with "B2" bracket.

2. Semi-recessed Fire Extinguisher Cabinet (FEC-1): "MP10" Extinguisher with "Gemini Series Model [FS-]G-2409-6R"; semi-recessed cabinet, projecting 2-1/2", rough opening of 10-1/2"W x 25"H x 4"D.
  3. Surface Mounted Fire Extinguisher Cabinet (FEC-2): "MP10" Extinguisher with "Gemini Series Model [FS-]G-2409-SM "; surface-mounted cabinet.
  4. Recessed Fire Hose and Valve Cabinet with Fire Extinguisher (FVC-1): "MP10" Extinguisher with "[FS-]G-3238-R"; Recessed Fire Hose and Valve Cabinet, projecting 2-1/2", rough opening of 34-1/8"W x 40-1/8"H x 9-1/8"D.
  5. Semi-recessed Fire Hose and Valve Cabinet with Fire Extinguisher (FVC-2): "MP10" Extinguisher with "[FS-]G-3238-RL"; Semi-Recessed Fire Hose and Valve Cabinet, projecting 2-1/2", rough opening of 33"W x 39"H x 6"D.
- B. Cabinet:
1. Semi-Recessed Fire Extinguisher Cabinet: 18 gauge steel with acrylic thermosetting enamel finish box construction, rolled-edge trim type, matching continuous hinge, pull handle, 1/4" Frameless Acrylic door, baked enamel coated steel trim.
    - a. Door Style to be Larson "Gemini" series door with black vertical letters on white background stating equipment in cabinet, or approved substitution by other listed manufacturers.
      - 1) Provide lock similar to "Larsen-Loc" on all cabinets.
    - b. Finish: White finish for box and trim.
    - c. Provide black text "FIRE EXTINGUISHER" on side of cabinet where required by code.
  2. Surface Mounted Fire Extinguisher Cabinet: 18 gauge steel with acrylic thermosetting enamel finish box construction, matching continuous hinge, pull handle, 1/4" Frameless Acrylic door, baked enamel coated steel trim..
    - a. Door Style to be Larson "Gemini" series door with black vertical letters on white background stating equipment in cabinet, or approved substitution by other listed manufacturers.
      - 1) Provide lock similar to "Larsen-Loc" on all cabinets.
    - b. Finish: White finish for box and trim.
  3. Recessed Fire Hose and Valve Cabinet: 18 gauge steel with acrylic thermosetting enamel finish box construction, flat trim type, matching continuous hinge, pull handle, 1/4" Frameless Acrylic door, baked enamel coated steel trim.
    - a. Door Style to be Larson "Full Glass", or approved substitution by other listed manufacturers. Glazing to be Clear Tempered Safety Glass.
      - 1) Provide lock similar to "Larsen-Loc" on all cabinets.
    - b. Finish: White finish for box and trim.
    - c. Provide black text "FIRE EXTINGUISHER" on front of glass where required by code.
  4. Semi-recessed Fire Hose and Valve Cabinet: 18 gauge steel with acrylic thermosetting enamel finish box construction, rolled-edge trim type, matching continuous hinge, pull handle, 1/4" Frameless Acrylic door, baked enamel coated steel trim.
    - a. Door Style to be Larson "Full Glass", or approved substitution by other listed manufacturers. Glazing to be Clear Tempered Safety Glass.
      - 1) Provide lock similar to "Larsen-Loc" on all cabinets.
    - b. Finish: White finish for box and trim.
    - c. Provide text "FIRE EXTINGUISHER" on side of cabinet where required by code.
- C. Mounting Hardware: Appropriate to Cabinet
- D. Fabrication
1. Form body of cabinet with tight inside corners and seams.
  2. Pre-drill holes for anchorage.
  3. Form perimeter trim and door stiles by welding, filling, and grinding smooth.
  4. Hinge doors for 180 degree opening with continuous piano hinge. Provide pull handle and roller type catch.

## **2.05 FINISHES**

- A. Extinguishers: Red Enamel

## **EXECUTION**

### **3.01 INSPECTION**

- A. Verify rough openings for cabinet are correctly sized and located.
- B. Beginning of installation means acceptance of existing conditions.

### **3.02 INSTALLATION**

- A. Install cabinets plumb and level in wall openings. Secure rigidly in place in accordance with manufacturer's instructions.

**END OF SECTION**

## **SECTION 10 51 13**

### **METAL LOCKERS**

#### **GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Locker Units with Hinged Doors
  - 2. Base, Top, and Filler Panels
  - 3. Hooks, Latches, and Hardware
  - 4. Attachment Hardware
- B. Related Sections:
  - 1. Section 06 10 00 (06100) - Rough Carpentry: Blocking for attachment

##### **1.02 SYSTEM DESCRIPTION**

- A. Lockers: Two-tier locker. Provide standard recessed padlock handle, number plate bases, end panels, filler panels, matching sloped top and top filler panels.
- B. Lockers: Three-tier locker. Provide standard recessed padlock handle, number plate bases, end panels, filler panels, matching sloped top and top filler panels.

##### **1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit Shop Drawings and product data that clearly indicate locker types, sizes, configurations, layout of groups of lockers, benches, accessories, and numbering plan.
  - 2. Submit manufacturer's installation instructions and actual color samples, on squares of same metal to be used for fabrication.

##### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store and protect locker finishes and adjacent surfaces from damage during installation.

#### **PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. Preferred Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. "Industrial"; Lyon Workspace Products LLC (800-433-8488)
    - a. Color: Refer to Interior Finish Index

##### **2.02 "VANGUARD LOCKERS"; PENCO PRODUCTS, INC. (800-562-1000)**

- A. Color: Refer to Interior Finish Index
  - 1. "Emperor Locker System"; Hadrian Manufacturing, Inc. (905-333-0300)
    - a. Color: Refer to Interior Finish Index

##### **2.03 LOCKER MATERIALS**

- A. Sheet Steel: ASTM A1008, Mild, stretcher-leveled cold-rolled carbon sheet steel free of buckling, scale, and surface imperfections of the following minimum thicknesses:
  - 1. Body and Shelf: 24 Gauge
  - 2. Doors: 16 Gauge
  - 3. Door Frames: 16 Gauge
  - 4. Hinges: Minimum 2" wide, full loop, tight pin type.

##### **2.04 LOCKER ACCESSORIES**

- A. Provide each locker with metal number plate, rubber bumpers, and hat/bookshelf.

## 2.05 LOCKER FABRICATION

- A. Locker Units: Provide the following types in locations shown on the Drawings:
  - 1. Two tier units, each locker to be 12" wide x 15" deep x 36" high.
  - 2. Three tier units, each locker to be 12" wide x 15" deep x 24" high.
- B. Bodies: Formed and flanged with stiffener ribs; electrically spot welded.
- C. Door Frame: Formed channel shape, welded and ground flush, welded to body.
- D. Doors: Welded inner and outer faces; channel reinforced top and bottom with intermediate stiffener ribs. Finish edges smooth.
- E. Hinges: Three full loop hinges. Weld securely to unit body and secure to door with no fewer than 2 factory installed fasteners that are completely concealed and tamperproof when door is closed.
- F. Recessed Handle and Latch: Manufacturer's standard housing to form a recess for latch lifter and locking devices; non-protruding latch lifter containing strike and eye for padlock; and automatic, pre-locking, pry-resistant latch with latching action with not less than three-point latching. Locking device supplied by Owner.
- G. Provide finished filler panels, end panels, continuous sloped 20-gauge metal tops and top filler panels to close off all openings, finished to match lockers.
  - 1. Sloped tops are to be in lengths as long as practicable, but not less than four lockers.
- H. Provide matching 12 gage, "Z" type base, 4" high at non-recessed lockers.
- I. Trim: 3", 18 gauge steel matching trim for recessed lockers.
- J. Provide full perimeter concealed ventilation system.
- K. Finish edges smooth without burrs.
- L. Provide number plates.
- M. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch. Weld frame members together to form a rigid, one-piece structure.
  - 1. Form locker body panels, doors, shelves and accessories from one-piece steel sheet unless otherwise indicated.
- N. Accessible Lockers:
  - 1. Accessible Locker to meet ICC/ANSI A117.1-2003-Side Reach Requirement: Single tier lockers shall have a hat/book shelf and coat hooks located no more than 46-inches above the finished floor. One additional shelf shall be placed near the bottom of the locker so that it is no lower than 15-inches above finished floor.
  - 2. Apply a decal with the international symbol of accessibility to the face of the designated handicapped accessible single tier locker, refer to Drawings for location.

## 2.06 FINISHES

- A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel, color as selected by Architect from standard colors.
- B. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- C. Finish all steel surfaces and accessories, except prefinished stainless-steel and chrome-plated surfaces.
- D. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering prior to shipment.
- E. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and they are assembled or installed to minimize contrast.

## **EXECUTION**

### **3.01 PREPARATION**

- A. Verify bases are properly sized and located.

### **3.02 INSTALLATION**

- A. Install metal lockers complete with accessories according to manufacturer's recommendations. Install plumb, level, rigid, flush and in-line.
- B. Anchor lockers with appropriate anchor devices to suit materials encountered, to floor and walls. Apply fasteners through back-up reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.
- C. Bolt adjoining locker units together to provide rigid installation.
- D. Install end panels, filler panels, and tops to completely close-off all openings.
- E. Anchor lockers to floors and walls at intervals recommended by manufacturer but no greater than 36 inches (910 mm). Install anchors through back-up reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.
  - 1. Install recess trim to recessed lockers using concealed fasteners. Provide hairline joints and concealed splice plates.
  - 2. Install sloping top units to lockers using concealed fasteners. Provide hairline joints and concealed splice plates.
  - 3. Install finished end panels to conceal exposed ends of non-recessed lockers.

### **3.03 ADJUST AND CLEAN**

- A. Adjust doors and latches to operate easily without bending. Verify that integral locking devices are operating properly.
- B. Touch-up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.
- C. Clean interior and exposed exterior surfaces and polish steel and non-ferrous metal surfaces.
- D. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

**END OF SECTION**

**SECTION 11 23 00**  
**COMMERCIAL LAUNDRY AND DRY CLEANING EQUIPMENT**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Laundry and Dry Cleaning Equipment.
- B. Related Sections:
  - 1. Section 06 10 00 (06100) - Rough Carpentry.
  - 2. Section 10 28 00 (10800) - Toilet, Bath, and Laundry Accessories: Coordinate equipment lists and schedules.
  - 3. Section 12 30 00 (06400) - Architectural Woodwork.
  - 4. Division 23 (15) - Mechanical
  - 5. Division 26 (16) - Electrical
  - 6. Food Service & Laundry Equipment Product Manual

**1.02 SUBMITTALS**

- A. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) with the following supporting data:
  - 1. Product Data: Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this Project.
  - 2. Shop Drawings:
    - a. Indicate cabinet sizes, materials, details of construction, methods of fastening, location of built-in appliances and erection details.
    - b. Indicate locations of plumbing and electrical rough-ins.
  - 3. Samples: Submit samples of wood finish.

**1.03 QUALITY ASSURANCE**

- A. Reference Standards: Applicable requirements of standards and specifications referenced herein apply to the work of this Section.
- B. Regulatory Requirements:
  - 1. Conform to all applicable codes for utility requirements.
  - 2. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
  - 3. All gas-fired equipment shall be AGA-Approved and provided with 100% safety pilot lights. Any electric ignition devices or high-heat sensors shall be UL Listed and AGA-Approved.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store products clear of floor in a manner to prevent damage.
- B. Coordinate size of access and route to place of installation.

**1.05 PROJECT CONDITIONS**

- A. Coordinate the work with location and placement of utilities. Coordinate characteristics of utilities with requirements of food service equipment.
- B. Schedule Work to immediately follow installation of utilities and precede installation of room finishes.
- C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

**PRODUCTS**

**2.01 EQUIPMENT**

- A. Refer to Food Service & Laundry Equipment Product Manual

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Verify condition of existing conditions before starting work. Verify ventilation outlets, service connections, and supports are correct and in required location. Verify that electric power is available and of the correct characteristics.

### **3.02 INSTALLATION**

- A. Install items in accordance with manufacturers' instructions. Verify water and drains are correct and in the required locations.
- B. Insulate to prevent electrolysis between dissimilar metals.
- C. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements.
- D. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- E. Cut, fit, and patch where necessary. Provide cutting and patching of items of this section required for installation or services of equipment. Any field cutting, joining, or patching shall be shop quality, match the surrounding material, and be fully finished and regained.
- F. Cut and drill components for service outlets, fixtures, and fittings.
- G. Use anchoring devices appropriate for equipment and expected usage. Wall blocking to be provided of a size and strength necessary to support all wall mounted equipment.
- H. Provide clear silicone sealant to achieve clean joint with adjacent building finishes and between abutting components.

### **3.03 ADJUSTING**

- A. Adjust equipment and apparatus to ensure proper working order and conditions.
- B. Remove and replace equipment creating excessive noise or vibration.

### **3.04 CLEANING**

- A. Remove masking or protective covering from stainless steel and other finished surfaces.
- B. Wash and clean equipment.
- C. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

**END OF SECTION**



**SECTION 11 25 13**  
**REGISTRATION EQUIPMENT**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Deposit Boxes
  - 2. Employees Depository Safe
- B. Related Sections:
  - 1. Section 05 50 00 (05500) - Metal Fabrications
  - 2. Section 06 10 00 (06100) - Rough Carpentry
  - 3. Section 12 30 00 (06400) - Architectural Woodwork

**1.02 SUBMITTALS**

- A. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) with the following supporting data:
  - 1. Product Data: Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this project.

**PRODUCTS**

**2.01 DEPOSIT BOXES**

- A. Manufacturers:
- B. Sizes and Configuration:
  - 1. Provide Openings 5" x 5", openings 5" x 10-3/8", and opening " x 1"
- C. Door Face Material: Polished Aluminum with black filled numbers.

**2.02 EMPLOYEES DEPOSITORY SAFE**

- A. Manufacturers:
- B. Size, outside measurement (verify with manufacturer's submittal).
  - 1. Height: 25-1/4 inches
  - 2. Width: 16-1/2 inches
  - 3. Depth: 23 inches (add 2 inches for handle)
  - 4. Coordinate size and locations with Drawings
  - 5. Provide combination lock with three locking bolts
  - 6. Provide four-compartment coin rack
- C. "B" rated door with single lock bolt.
- D. DP Hopper style cash drop, 2" x 10" x 8".

**EXECUTION**

**3.01 INSTALLATION**

- A. Install in accordance with equipment manufacturer's instructions.
- B. Coordinate with approved shop drawings for millwork and Section 12 30 00 (06400) - Architectural Woodwork.

**END OF SECTION**

**SECTION 11 40 00**  
**FOOD SERVICE EQUIPMENT**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Food Service Equipment
  - 2. Vending Equipment
  - 3. Buffet Shield System (Sneeze Guard)
- B. Related Sections:
  - 1. Section 01 79 00 (01820) - Training
  - 2. Section 06 10 00 (06100) - Rough Carpentry
  - 3. Section 10 28 00 (10800) - Toilet, Bath, and Laundry Accessories
  - 4. Section 12 36 06 (06415) - Metal Countertops: Stainless Steel Countertops not associated with Food Service Equipment.
  - 5. Section 12 32 13 (06400) - Manufactured Wood-Veneer-Faced Casework
  - 6. Section 12 32 16 (06400) - Manufactured Plastic Laminate Clad Casework
  - 7. Division 23 (15) Sections: Plumbing Fixtures and Equipment
  - 8. Division 26 (16) Sections: Basic Electrical Materials and Methods
  - 9. Food Service & Laundry Equipment Product Manual

**1.02 QUALITY ASSURANCE**

- A. Reference Standards: Applicable requirements of standards and specifications referenced herein apply to the work of this Section.
- B. Regulatory Requirements:
  - 1. Conform to all applicable codes for utility requirements.
  - 2. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

**1.03 ALL GAS-FIRED EQUIPMENT SHALL BE AGA-APPROVED AND PROVIDED WITH 100% SAFETY PILOT LIGHTS. ANY ELECTRIC IGNITION DEVICES OR HIGH-HEAT SENSORS SHALL BE UL LISTED AND AGA-APPROVED.**

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store products clear of floor in a manner to prevent damage.
- B. Coordinate size of access and route to place of installation.

**1.05 PROJECT CONDITIONS**

- A. Coordinate the work with location and placement of utilities. Coordinate characteristics of utilities with requirements of food service equipment.
- B. Schedule Work to immediately follow installation of utilities and precede installation of room finishes. Coordinate with Owner.
- C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

**PRODUCTS**

**2.01 FOOD SERVICE EQUIPMENT**

- A. Refer to Food Service & Laundry Equipment Product Manual

**2.02 VENDING EQUIPMENT**

- A. Refer to Food Service & Laundry Equipment Product Manual

**2.03 BUFFET SHIELD SYSTEM (SNEEZE GUARD)**

- A. Refer to Food Service & Laundry Equipment Product Manual

## **EXECUTION**

### **3.01 EXAMINATION**

- A. Verify condition of existing conditions before starting work. Verify ventilation outlets, service connections, and supports are correct and in required location. Verify that electric power is available and of the correct characteristics.

### **3.02 INSTALLATION**

- A. Install items in accordance with manufacturers' instructions. Verify water and drains are correct and in the required locations.
- B. Insulate to prevent electrolysis between dissimilar metals.
- C. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements.
- D. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- E. Cut, fit, and patch where necessary. Provide cutting and patching of items of this section required for installation or services of equipment. Any field cutting, joining, or patching shall be shop quality, match the surrounding material, and be fully finished and regained.
- F. Cut and drill components for service outlets, fixtures, and fittings.
- G. Use anchoring devices appropriate for equipment and expected usage. Wall blocking to be provided of a size and strength necessary to support all wall mounted equipment.
- H. Provide clear silicone sealant to achieve clean joint with adjacent building finishes and between abutting components.

### **3.03 ADJUSTING**

- A. Adjust equipment and apparatus to ensure proper working order and conditions.
- B. Remove and replace equipment creating excessive noise or vibration.

### **3.04 CLEANING**

- A. Remove masking or protective covering from stainless steel and other finished surfaces.
- B. Wash and clean equipment.
- C. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

**END OF SECTION**

**SECTION 12 32 13**  
**MANUFACTURED WOOD-VENEER-FACED CASEWORK**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Custom Cabinet Units
    - a. Wood, Transparent Finish, Custom Cabinet Units
    - b. Powder Coated Medium Density Fiberboard (MDF)
- B. Cabinet Style

<b>FAIRFIELD INN &amp; SUITES</b>	<b>GUESTROOM</b>	<b>PERSPECTIVES</b>	<b>FFE ONLY</b>
	<b>PUBLIC SPACE</b>	<b>PERSPECTIVES</b>	<b>CUSTOM PLASTIC LAMINATE / CUSTOM WOOD VENEER</b>
	<b>BACK-OF-HO USE</b>	<b>PERSPECTIVES</b>	<b>CUSTOM PLASTIC LAMINATE / CUSTOM WOOD VENEER</b>

- A. Cabinet Hardware
- B. Decorative Glass for Guestroom Cabinets
- C. Illuminated Metal Mesh at Front Desk and Bar.
- D. Metal Mesh Bi-passing Doors at Bar/Bistro
- E. Related Sections:
  - 1. Section 06 61 00 (06100) - Rough Carpentry
  - 2. Section 06 20 00 (06200) - Finish Carpentry
  - 3. Section 08 80 00 (08800) - Glazing
  - 4. Section 12 32 16 (06400) - Manufactured Plastic Laminate Clad Casework
    - a. Section 12 35 30.13 (06400) - Kitchen Casework
    - b. Section 12 36 23 (09415) - Plastic Countertops
    - c. Section 12 36 40 (09380) - Stone Countertops
    - d. Section 12 36 61 (09835) - Simulated Stone Countertops
    - e. Section 12 36 61.13 (06620) - Cultured Marble Countertops
    - f. Section 12 36 61.16 (06620) - Solid Surfacing Countertops
  - 5. Division 22 (15) for Plumbing Fixtures

**1.02 REFERENCES**

- A. Architectural Woodwork Institute (AWI) / Architectural Woodwork Manufacturers Association of Canada (AWMAC) / Woodwork Institute (WI) Publications:
  - 1. "Architectural Woodwork Standards (AWS)"
- B. ASTM International (ASTM) Publications:
  - 1. C1048 "Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass"
  - 2. D523 "Standard Test Method for Specular Gloss"
  - 3. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
- C. American National Standards Institute (ANSI) Publications:
  - 1. A135.4 Basic Hardboard
  - 2. ANSI/KCMA A161.1 "Performance and Construction Standard for Kitchen and Vanity Cabinets
  - 3. A161.2 "Standards for Fabricated High Pressure Decorative Laminate Countertops"
  - 4. A208.1 "Standards for the Performance of Particleboard"
- D. Federal Specifications (FS) Publications:

1. FS MM-L-736 - Lumber, Hardwood
2. FS MMM-A-130 - Adhesive, Contact
- E. Forest Stewardship Council (FSC) Publications:
  1. FSC 1.2, "Principles and Criteria."
- F. Hardwood Plywood & Veneer Association (HPVA) Publications:
  1. ANSI/HPVA HP-1: "American National Standard for Hardwood and Decorative Plywood"
- G. National Electrical Manufacturer's Association (NEMA) Standards Publications:
  1. NEMA LD3 "High Pressure Decorative Laminates"
- H. U.S. Department of Commerce (DOC), National Institute of Standards and Technology (NIST) Publications
  1. PS 1 - Construction and Industrial Plywood
  2. PS 20 - American Softwood Lumber Standard
  3. PS 51 - Hardwood and Decorative Plywood
  4. PS 58 - Basic Hardboard

### **1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  1. Submit Shop Drawings and product data. Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes.
    - a. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
    - b. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
- C. Qualification Data: For Fabricator

### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver casework until painting and similar operations that could damage synthetic marble have been completed in installation areas. If casework components must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

### **1.05 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where casework is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed and indicate measurements on Shop Drawings.

## **PRODUCTS**

### **2.01 APPROVED MANUFACTURERS**

- A. Manufacturers:
  1. None
- B. Approved Manufacturers:
  1. MillRock RiverRun Casework (540-438-5973)

2. R.B. Woodcraft, Inc. (315-474-2429)
3. J. Suss Industries Inc. (866-769-5666)

## 2.02 WOOD, TRANSPARENT FINISH CUSTOM BOX CABINET UNITS - GENERAL

- A. Quality Standard:
  1. Perform work to meet the requirements of Custom Grade in accordance with the "Architectural Woodwork Standards (AWS)", unless noted otherwise manufactured from solid stock meeting the following requirements:
    - a. Minor warp which can be held flat and straight with normal nailing.
    - b. Natural and manufacturing defects in excess of those permitted in the grade specified are permitted if such defects are to be covered by adjoining members or otherwise concealed.
    - c. Trim members for application on flat surfaces shall have the reverse side "backed out", except members with exposed ends.
    - d. "Custom grade" pieces shall be smoothly machined with top flat surfaces machine sanded. Depressed flat surfaces and molded contours shall be smoothly machined.
- B. Design:
  1. Style of face construction for base, wall, and full-height units, if any, with drawer fronts, doors, and fixed panels as follows:
    - a. Face Frame or Frameless.
      - 1) All cabinets shall be the same construction type for the entire Project.
        - (a) Cabinet and Door Interface: Flush (Full) Overlay.
        - (b) Flush Panel Doors.
        - (c) Flush Panel Drawer Fronts.
        - (d) Color: Refer to Interior Finish Index
  2. Grain Direction:
    - a. Vertical on doors, horizontal on drawer fronts.
    - b. Lengthwise on face frame members.
    - c. Vertical on end panels.
    - d. Side to side on bottoms and tops of units.
    - e. Vertical on knee-space panels.
    - f. Horizontal on aprons.

## 2.03 MATERIALS

- A. Lumber shall be in accordance with the AWS Grade specified for the product being fabricated. Moisture content shall be 6% to 12% for boards up to 2-inches nominal thickness, and shall not exceed 19% for thicker pieces.
- B. Solid Lumber: Dry, sound, selected to eliminate appearance defects. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings. Provide the following species:
  1. [Hard Maple - "Select White" (Sapwood)] [or] [Yellow Birch - "Select White" (Sapwood)], plain (flat) sliced, custom grade.
- C. Plywood Face Veneer: HPVA HP-1. Same species as exposed lumber, unless otherwise indicated, selected for grain and color compatible with exposed solid lumber, with Grade A faces and Grade C backs of same species as faces, no defects. Edgeband exposed edges with solid wood of same species as face veneer.
  1. [Hard Maple - "Select White" (Sapwood), plain (flat) sliced] [or] [Yellow Birch - "Select White" (Sapwood), rotary sliced], custom grade.
- D. Particle Board: ANSI A208.1, Mat-Formed Particle Board, Grade 1-M-2, with minimum density of 45 pcf. Internal bond of 60 psi, and minimum screw holding capacity of 225 lb. on faces and 200 lb. on edges.
- E. Hardboard: ANSI A135.4, Class 1, tempered.
- F. MDF: ANSI A208.2, Grade 130.

- G. Thermoset Decorative Overlay (Melamine): Not less than 100 gram thermally fused, melamine-impregnated decorative paper, complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Finish shall be resistant to water and mild cleaners.
- H. Edgebanding for use Thermoset Decorative Overlay (Melamine) finished Panels: PVC or polyester edgebanding matching thermoset decorative overlay.
- I. Decorative Glass for Cabinet Doors:
  - 1. Sandblasted Glass: Heat Treated Float Glass, ASTM C1048, Type I, Class 1, Quality Q3, Condition A, Kind FT (Fully Tempered), 3/16-inch thick, unless otherwise indicated.
    - a. Provide evenly abraded sandblasted or Acid-Etched Finish. Translucent Pattern as approved by Owner's Representative.
  - 2. Refer to Drawings for locations and size.
- J. Illuminated Metal Mesh at Front Desk, Bar, and Accent Panel at Vestibule/Cart Wall
- K. Powder Coated Medium Density Fiberboard
  - 1. Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. BTD Wood Powder Coating, Inc. (218-828-4144)
    - b. No Substitutions
  - 3. Materials
    - a. Medium Density Fiberboard (MDF) CARB II Compliant (Standard). MDF board shall be 48 pound per cubic foot density, industrial grade.
      - 1) ¾ inch thick as used for all tops and surfaces
      - 2) CARB II Compliant
        - (a) Thermally cured Powder coated MDF
  - 4. Finishes:
    - a. Top and Surface Finish Specifications:
      - 1) Tops and surfaces shall be finished with powder coat on MDF.
      - 2) Color: Refer to Interior Finish Index.

## **2.04 FABRICATION - GENERAL**

- A. General:
  - 1. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
  - 2. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trip for scribing and site cutting.
  - 3. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings.

## **2.05 FABRICATION - FACE-FRAME CABINETS**

- A. General:
  - 1. Face Frame Rails and Stiles: Not less than 3/4-inch by 1-1/2 inch solid lumber with glued mortise and tendon joints.
  - 2. Exposed and Semi-exposed Ends; Top and Bottom Rails; and Sub-toe Boards:
    - a. Not less than 1/2-inch hardwood plywood with exterior veneer to match door and drawer fronts. Machine ends for wood-dowel or mechanical dowel fasteners to receive top, bottom, and back. Rabbit base ends to receive bottom and back. Base ends to extend to floor. Finish exposed ends to match doors and doors and drawer fronts. Finish interior with clear finish.
    - b. Connect to stiles with pressure-glued tongue and plow joint and supplement by concealed mechanical fasteners. Finish exposed ends to match doors and drawers. If wood veneered materials used, clear coat interior to achieve water resistant cleanable surface.

3. Unexposed Ends: Not less than 1/2-inch thick, hardwood plywood. Attach to front frame in same manner as exposed ends.
  4. Back Panels:
    - a. Not less than 1/4-inch hardwood plywood; clear coat interior to achieve water resistant cleanable surface.
    - b. Doors 48 Inches or Less in Height: 3/4 inch thick, with solid hardwood stiles and rails, Particle Board or MDF cores, and hardwood face veneers and crossbands. Provide stop silencers at the top and bottom of all hinged doors.
      - 1) Secure glass into rabbet in door frame in locations shown on Drawings using a clear flexible vinyl retainer molding "Model No. C-10215", as manufactured by Top Supplies, a division of Richelieu Hardware (800-619-5446), or approved substitution. Glass clips are also permitted.
  5. Shelving: Not less than 5/8" particle board with Thermoset Decorative Overlay (Melamine) to match cabinet interior, PVC edge banding; adjustable at least every 1-1/2 inch; clear plastic [seismic] shelf clip pressed into 5mm holes bored in cabinet side. Fabricate base shelf to half depth.
  6. Filler Strips:
    - a. Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.
    - b. Oversize for field cutting to suit field conditions and assure continuous enclosure of open spaces.
    - c. Provide raw (unfinished) cleats at blind corners and appliance openings as required to support countertops, minimum 3/4-inch x 1-1/2 inch x 8 foot length, to be field cut and fit by the installer
    - d. Interior Cabinet Finish:
      - 1) Public Space Casework: Interior face of cabinet units that have surfaces that are exposed shall be Thermoset Decorative Overlay (melamine) in color to match door front.
      - 2) Public Space Casework Wet Areas: Interior unexposed face of units that are likely to become wet (such as cabinets housing refrigerated cold pans) should be constructed of polyester overlaid plywood cabinet liner materials:
        - (a) Approved Manufacturer: "Cabinet Liner Industrial Panel"; Olympic Panel Products, LLC (800-782-7265), or approved substitution.
  7. Interior Cabinet Finish:
    - a. Back-of-House Casework: Interior face of cabinet units that have surfaces that are exposed shall be White Thermoset Decorative Overlay (melamine).
    - b. Public Space Casework Wet Areas: Interior unexposed face of units that are likely to become wet (such as cabinets housing refrigerated cold pans) should be constructed of polyester overlaid plywood cabinet liner materials:
      - 1) Approved Manufacturer: "Cabinet Liner Industrial Panel"; Olympic Panel Products, LLC (800-782-7265), or approved substitution.
- B. Base Cabinet Units:
1. Base Cabinet Top Frames: 3/4-inch solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
  2. Base Cabinet Stretchers: 3/4-by-4-1/2-inch plywood, Particle Board, or MDF strips or solid-wood boards at front and back of cabinet, glued and pinned or screwed.
    - a. Base Cabinet Stretchers may be provided as an option to base cabinet top frames.
    - b. Front Frame Drawer Rails: Not less than 3/4-inch solid wood mortised and fastened into face frame.
  3. Bottoms: Not less than 1/2-inch hardwood plywood with exterior veneer to match door and drawer fronts, fully supported by and secured in rabbets in end panels, front frame, and back bottom rail.
  4. Corner Blocks: Glued and fastened in each of four top corners to maintain cabinet squareness and rigidity.
  5. Drawers:



- a. Provide box-type construction with sub-front and back joined with glued dovetail or rabbeted into sides and secured with glue and mechanical fasteners. Clear coat all exposed surfaces. Match color of sides and bottoms with drawer fronts.
  - b. Drawer Fronts: 3/4-inch Particle Board-core hardwood veneered plywood or solid hardwood.
  - c. Drawer Sides Sub-fronts, and Backs: Not less than 1/2-inch solid hardwood or veneered plywood.
  - d. Exposed fronts fastened to Sub-fronts with mounting screws from interior of body.
  - e. Drawer bottom of not less than 1/4-inch veneer hardboard, set into rabbets in back, sides, and sub-fronts.
- C. Wall Cabinet Units:
- 1. Tops and Bottoms: Not less than 1/2-inch hardwood veneered plywood with exterior veneer to match door fronts, fully supported by and secured in rabbets in end panels, front frame, and back rail.

## 2.06 FABRICATION - FRAMELESS CABINETS

- A. General:
- 1. Exposed and Semi-exposed Ends; Top and Bottom Rails; and Sub-toe Boards:
    - a. Not less than 3/4-inch Particle Board with Thermoset Decorative Overlay (Melamine) to match door and drawer fronts. Machine ends for wood-dowel or mechanical dowel fasteners to receive top, bottom, and back. Base ends to extend to floor. Finish exposed ends to match doors and drawers and drawer fronts.
  - 2. Unexposed Ends: Not less than 3/4-inch hardboard or particle board; finished with Thermoset Decorative Overlay (Melamine). Attach to front frame in same manner as exposed ends.
  - 3. Back Panels:
    - a. Not less than 1/4-inch tempered hardboard or MDF; finished with Thermoset Decorative Overlay (Melamine).
    - b. Doors 48 Inches or Less in Height:
      - 1) Flush (Slab) Style Doors: 3/4 inch thick, Particle Board or MDF cores, and hardwood face veneers and edge tape.
      - 2) Single Fixed Panel Stile and Rail Style Doors: 3/4 inch thick, with solid hardwood stiles and rails, Particle Board or MDF cores, and hardwood face veneers and crossbands.
      - 3) Provide stop silencers at the top and bottom of all hinged doors.
      - 4) Secure glass into rabbet in door frame in locations shown on Drawings using a clear flexible vinyl retainer molding "Model No. C-10215", as manufactured by Top Supplies, a division of Richelieu Hardware (800-619-5446), or approved substitution. Glass clips are also permitted.
  - 4. Shelving: Not less than 5/8" board with Thermoset Decorative Overlay (Melamine) to match cabinet interior, PVC edge banding; adjustable at least every 1-1/2 inch; clear plastic [seismic] shelf clip pressed into 5mm holes bored in cabinet side. Fabricate base shelf to half depth.
  - 5. Filler Strips:
    - a. Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.
    - b. Oversize for field cutting to suit field conditions and assure continuous enclosure of open spaces.
    - c. Provide raw (unfinished) cleats at blind corners and appliance openings as required to support countertops, minimum 3/4-inch x 1-1/2 inch x 8 foot length, to be field cut and fit by the installer
    - d. Interior Cabinet Finish:
      - 1) Public Space Casework: Interior face of cabinet units that have surfaces that are exposed shall be Thermoset Decorative Overlay (melamine) in color to match door fronts.

- 2) Public Space Casework Wet Areas: Interior unexposed face of units that are likely to become wet (such as cabinets housing refrigerated cold pans) should be constructed of polyester overlaid plywood cabinet liner materials:
  - (a) Approved Manufacturer: "Cabinet Liner Industrial Panel"; Olympic Panel Products, LLC (800-782-7265), or approved substitution.
6. Interior Cabinet Finish:
  - a. Back-of-House Casework: Interior face of cabinet units that have surfaces that are exposed shall be White Thermoset Decorative Overlay (melamine).
  - b. Public Space Casework Wet Areas: Interior unexposed face of units that are likely to become wet (such as cabinets housing refrigerated cold pans) should be constructed of polyester overlaid plywood cabinet liner materials:
    - 1) Approved Manufacturer: "Cabinet Liner Industrial Panel"; Olympic Panel Products, LLC (800-782-7265), or approved substitution.
- B. Base Cabinet Units:
  1. Base Cabinet Top Frames: 3/4-inch solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
  2. Base Cabinet Stretchers: 3/4-by-4-1/2-inch plywood, Particle Board, or MDF strips or solid-wood boards at front and back of cabinet, glued and pinned or screwed.
    - a. Base Cabinet Stretchers may be provided as an option to base cabinet top frames.
  3. Bottoms: Not less than 1/2-inch hardwood plywood with exterior veneer to match door and drawer fronts, fully supported by and secured in rabbets in end panels, front frame, and back bottom rail.
    - a. Corner Blocks: Glued and fastened in each of four top corners to maintain cabinet squareness and rigidity, or provide plastic or composite glue blocks. Full cabinet rails are an acceptable alternate to corner blocks.
  4. Drawers:
    - a. Provide box-type construction with sub-front and back joined with glued dovetail or rabbeted into sides and secured with glue and mechanical fasteners. Clear coat all exposed surfaces. Match color of sides and bottoms with drawer fronts.
    - b. Drawer Fronts: 3/4-inch Particle Board-core hardwood veneered plywood or solid hardwood.
    - c. Drawer Sides Sub-fronts, and Backs: Not less than 1/2-inch veneer hardwood, or solid hardwood with dovetail construction.
    - d. Exposed fronts fastened to Sub-fronts with mounting screws from interior of body.
    - e. Drawer bottom of not less than 1/4-inch veneer hardboard, set into rabbets in back, sides, and sub-fronts.
- C. Wall Cabinet Units:
  1. Tops and Bottoms: Not less than 1/2-inch hardwood veneered plywood with exterior veneer to match door fronts, fully supported by and secured in rabbets in end panels, front frame, and back rail.

## 2.07 CABINET HARDWARE

- A. See Cabinet Hardware Schedule for list of which Manufacturer's are approved for use on a specific item.
- B. Manufacturers:
  1. None
- C. Approved Manufacturers
  1. Accuride International (562-903-0200)
  2. Blum, Inc. (800-438-6788)
  3. CompX Timberline (847-752-2600)
  4. Corbin Russwin Architectural Hardware, an ASSA ABLOY Group (800-543-3658)
  5. EpcO, The Engineered Products Co. (810-767-2050)
  6. Franklin Fixtures (508-291-1475)
  7. Grass America, Inc. (800-334-3512)

8. Hafele America Co. (800-423-3531)
9. H.B. Ives, an Ingersoll-Rand Company (800-820-5542)
10. Hercules Casters and Wheels (800-942-8717)
11. Hettich America, LP (800-777-1772)
12. J. G. Edelen Company, Inc. (410-918-1200)
13. Knape & Vogt Manufacturing Co. (800-253-1561) (KV)
14. Doug Mockett & Company, Inc. (800-523-1269)
15. Outwater Plastics Industries, Inc. (800-631-8375)
16. Polar Ware Company (800-237-3655)
17. Rockler Companies, Inc. (800-279-4441)
18. Selby Furniture Hardware Co., Inc. (718-993-3700)
19. Shepherd Caster Corporation (800-253-0868)
20. Stanley Hardware, Div. of the Stanley Works (800-493-5263)
21. Stylmark, Inc. (Garcy Corp.) (800-328-2495)
22. Victory Display & Store Fixture Mfg. (800-262-1126)

D. General: Provide cabinet hardware and accessory materials associated with architectural cabinets. Coordinate finishes of exposed cabinet hardware with adjacent finish hardware as specified in Section 08 71 00 (08710).

1. All exposed hardware to be US26D (626 Bronze) unless noted otherwise.

E. Cabinet Hardware Schedule:

<u>ITEM</u>	<u>MODEL NO.</u>	<u>MANUFACTURER</u>
<b>THE MARKET</b>		
Cabinet Pulls	DP41-A-3	EPCO
Cabinet Locks	280 Series (Drawers) 290 Series (Doors) C700LP-15 Plugs (This item keyed separately- See Note 2)	CompX-Timberline
Concealed Hinges	Tiomos Series	Grass America
Shelf Supports (non-exposed 5mm)	345	KV
Shelf Supports Pins and Bussings (Exposed 5mm)	326 Grommets w/ 330 Round Shelf Pins	KV
Barrister Drawer Slide	18235	Rockler

**OTHER HARDWARE**

(Refer to Section 12 32 16)

- Note 1: At drawer slides for large drawers, verify potential loading and adjust slide type to accommodate loads. For drawers over 16" wide and less than 24" wide use Accuride 7432. For applications wider than 24" use Accuride 3640.
- Note 2: All locks in the same component to be on the same key, unless noted otherwise. Other millwork items on the hotel property with locks shall be keyed separately. Ensure master key is different at each hotel in the system.

1. All exposed hardware to be US26D (626 Bronze) unless noted otherwise.

F. Cabinet Hardware Schedule:

<u>ITEM</u>	<u>MODEL NO.</u>	<u>MANUFACTURER</u>
<b>THE CORNER MARKET</b>		
Cabinet Pulls	DP41-A-3	EPCO
Cabinet Locks	280 Series (Drawers) 290 Series (Doors) C700LP-15 Plugs keyed alike	CompX-Timberline
Concealed Hinges	Tiomos Series	Grass America
Shelf Supports (non-exposed 5mm)	345	KV
Shelf Supports Pins and Bussings (Exposed 5mm)	326 Grommets w/ 330 Round Shelf Pins	KV
Barrister Drawer Slide	18235	Rockler

## OTHER HARDWARE

(Refer to Section 12 32 16)

Note 1: At drawer slides for large drawers, verify potential loading and adjust slide type to accommodate loads. For drawers over 16" wide and less than 24" wide use Accuride 7432. For applications wider than 24" use Accuride 3640.

1. All exposed hardware in Public Spaces to be US15 unless noted otherwise.
2. All exposed hardware in Guestrooms to be US26 unless noted otherwise.

### G. Cabinet Hardware Schedule:

<u>ITEM</u>	<u>MODEL NO.</u>	<u>MANUFACTURER</u>
<b>EMPLOYEE LOUNGE</b>		
Cabinet Pulls: Upper Cabinets	104.33.200	Hafele
Cabinet Pulls: Drawers	132.00.229	Hafele
<b>FRONT DESK</b>		
Brackets, Interior	187, 171, 173, and 179	K&V
Catch, Elbow	2 (Bronze)	Ives
Catch, Roller	336 (Bronze)	Ives
Drawer Locks		
Drawer Slides	3832	Accuride
Folding Table Brackets	250080 (Zinc)	Stanley
Hinges, Pivot	341	Stanley
Hinges, Continuous (Piano)	311-1/4 x 2-1/2" x 72"	Stanley
Magnetic Catches	323, 326, and 327	Ives
Pulls, Door and Drawer (Refer to Interior Finish Index for locations)	120.61.950 x Tarnished Silver	Hafele
Shelf Supports, Interior	256	K&V
Sliding Door Finger Pulls		
Sliding Door Lock		
Standards, Interior	255, 87, 71, & 80 (Anachrome)	K&V
<b>THE MARKET</b>		
Base Cabinet Legs	637.45.326	Hafele
Toe Kick Panel Clip	637.45.915	Hafele
Concealed Shelf Standard	T-Standard7/16" HB800-7	Victory Store Fixtures
Adjustable Shelf Bracket	179 Anochrome	KV
Shelf Fastener	154 Anochrome	KV
Glass Doors	3/16" Thick Tempered Safety Glass	
Glass Door Hinges (matt chrome)	316.33.300 Type 18	Hafele
Glass Door Hinge Round Trim Cap	316.10.420	Hafele
Cabinet Pulls	115.61.601	Stanley
Cabinet Pulls (Option)	4485 1/2	Stanley
Cabinet Locks	02066	Corbin
Concealed Hinges	1805 VZDT32	Grass America
Alum. Slatwall	# ALU7584-M	Outwater
Slatwall Hooks	Coordinate with Slatwall manufacturer.	
Condiment Container	2Y Bain Marie (Stain Steel)	Polarware
Metal Shelf (powder coated aluminum)	Flat Metal Shelf	Franklin Fixtures
Concealed Hinges	1805 VZDT32	Grass America

## GUESTROOMS

(Refer to Section 12 35 30.13)

Note 1: At drawer slides for large drawers, verify potential loading and adjust slide type to accommodate loads. For drawers over 16" wide and less than 24" wide use Accuride 7432. For applications wider than 24" use Accuride 3640.

## 2.08 CABINET HARDWARE SCHEDULE:

- A. Exposed Wall Shelving: "No. 80 x No. 182"; Knappe & Vogt Manufacturing Co.; inset type, adjustable on 1" centers.
  - 1. Cash Drawer With Lock
    - a. Furnished by Owner. Contractor shall coordinate size.
      - 1) Provide 1/8" clearance around all four sides, or as recommended by manufacturer.
  - 2. ILLUMINATED METAL MESH
    - a. "Model GW-911 Venetian"; The Gage Corporation International (800-786-4243)
  - 3. Metal Mesh Bi-passing Doors at Bar/Bistro
    - a. Manufacturers:
      - 1) None
    - b. Approved Manufacturers
      - 1) Door Framing System: Richelieu America
        - (a) Contact: Michael Baer (704-330-0114)
          - (1) Mesh: Banker Wire (800-523-6772)
      - (b) Door Framing System Components:
        - (1) Framing System: "Model 1936"; Richelieu America
        - (2) Trolley and Track System: "Model CA 4585"; Richelieu America
        - (3) Push Lock: "Model 1879201"; Richelieu America
        - (4) Cylinder: "Model 18006001"; Richelieu America
        - (5) Mesh: "Model PZ-11 Wire Mesh"; Banker Wire
    - c. Finish: Provide in Stainless Steel or Bronze. Refer to Drawings and Interior Finish Index.

## 2.09 INSTALLATION MATERIALS

- A. Furring, Blocking, SNote:hims, and Hanging Strips: Fire-retardant-treated Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
  - 1. Adhesives: Installation adhesives as recommended by manufacturer for use intended.

## 2.10 SHOP FINISHING

- A. Quality Standard: Comply with AWS Appendix B, unless otherwise indicated.
- B. General: Finish casework at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.
- D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D523:
  - 1. Grade: Custom.
  - 2. Finish System: TR-2 (custom), catalyzed lacquer.
    - a. Stain Color: Refer to Interior Finish Index.
    - b. 1 Coat precatalyzed sanding sealer
    - c. Sand (240 Grit)
    - d. 1 Coat colored sealer
    - e. 1 Coat precatalyzed sealer
    - f. Sand (320 Grit)
    - g. 1 Coat precatalyzed lacquer - 30% Sheen (semi-gloss) to match approved sample .

## **EXECUTION**

### **3.01 INSPECTION**

- A. Verify adequacy of backing and support framing.

### **3.02 INSTALLATION**

- A. All cabinets and shelving shall be installed as shown on Drawings and as specified by manufacturer.
- B. Set and secure casework in place rigid, plumb, and level.
- C. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
  - 2. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 3. Maintain veneer sequence matching of cabinets with transparent finish.
  - 4. Carefully scribe casework which is against other building materials, leaving gaps of 1/32 inch maximum. Do not use additional overly trim for this purpose.
  - 5. Carefully fit equipment to be installed into millwork. Provide filler pieces when required.
- D. Fasteners:
  - 1. Use purpose designed fixture attachments at concealed locations for wall-mounted components.
  - 2. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
  - 3. Countersink anchorage devices at exposed locations used to wall-mount components, and conceal with solid plugs of species to match surrounding wood. Finish flush with surrounding surfaces.
  - 4. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

### **3.03 INSTALLATION - GLAZING**

- A. Refer to Section 08 80 00 (08800) - Glazing, for installation methods.

### **3.04 ADJUSTING AND CLEANING**

- A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.
- B. Clean casework, shelves, hardware, fittings and fixtures.

**END OF SECTION**

**SECTION 12 36 23**  
**PLASTIC COUNTERTOPS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Plastic Laminate
    - a. Countertops and Backsplashes
    - b. Aprons
- B. Related Sections:
  - 1. Section 06 10 00 (06100) - Rough Carpentry
  - 2. Section 06 20 00 (06200) - Finish Carpentry
  - 3. Section 06 61 13 (06610) - Cultured Marble Fabrications
  - 4. Section 12 30 00 (06400) - Architectural Woodwork
  - 5. Section 12 36 40 (09380) - Stone Countertops
  - 6. Section 12 36 61 (09385) - Engineered Stone Countertops
  - 7. Section 12 36 61.13 (09385) - Cultured Marble Countertops

**1.02 REFERENCES**

- A. American National Standards Institute (ANSI) Publications:
  - 1. A161.2 "Performance Standards for Fabricated High Pressure Decorative Laminate Countertops"
  - 2. A208.1 "Particleboard"
- B. ASTM International (ASTM) Publications:
  - 1. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
- C. Federal Specifications (FS) Publications:
  - 1. MM-L-736 "Lumber, Hardwood"
  - 2. MMM-A-130 "Adhesive, Contact"
- D. National Electrical Manufacturer's Association (NEMA) Standards Publications:
  - 1. LD3 "High Pressure Decorative Laminates"
- E. National Institute of Standards and Technology (NIST)
  - 1. PS 1 "Construction and Industrial Plywood"
  - 2. PS 20 "American Softwood Lumber Standard"
  - 3. PS 51 "Hardwood and Decorative Plywood"
  - 4. PS 58 "Basic Hardboard"

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit Shop Drawings and product data. Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes.

**1.04 QUALITY ASSURANCE**

- A. Perform work to (custom) quality in accordance with "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute AWI
- B. Plastic Laminate Materials shall comply with NEMA LD-3 as follows:
  - 1. GP 50: Horizontal grade
  - 2. CL 20: Cabinet liner
  - 3. BK 20: Backing sheet
  - 4. PF-40: Post Forming Grade
  - 5. FR 50: Horizontal application, fire retardant material

6. FR 32: Vertical application, fire retardant material

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage synthetic marble have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

### 1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where countertop work is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support countertops by field measurements before being enclosed and indicate measurements on Shop Drawings.

## PRODUCTS

### 2.01 MATERIALS:

- A. Plastic Laminate: Shall be standard grade, 1/16" thick, general purpose material complying with current NEMA LD-3 Grade HGS for flat countertops [and HGP for postformed]. Comply with ANSI A161.2. Pattern and color shown in [Interior Finish Index].
  - 1. Approved Manufacturers:
    - a. Lamin-Art (800-323-7624)
    - b. Nevamar Company, LLC (800-638-4380)
    - c. Pionite Decorative Surfaces, a Panolam Industries International Incorporated Company (800-746-6483)
    - d. Formica Corporation (800-367-6422)
    - e. WilsonArt International, Inc. (800-433-3222)
- B. Particleboard Core:
  - 1. ANSI A208.1, Grade M-2.
- C. Fire-Retardant Core:
  - 1. Shall be Particleboard, complying with ANSI A208.1, 45-lb. density, minimum 3/4" thick fire retardant type in accordance with ASTM E84 and the following:
    - a. Flame Spread: 25 maximum
    - b. Smoke Developed: 25 maximum
    - c. Fuel Contributed: 25 maximum
- D. Adhesives:
  - 1. Wood Glue: Waterproof types as recommended by AWI standards for the particular application.
  - 2. Plastic Laminate: Non-Flammable Type:
    - a. Approved Manufacturers:
      - 1) "DAP Weld-Wood, Non-Flammable Type" - DAP, Inc. (888-327-8477)
      - 2) Approved substitution.
      - 3) Installation adhesives as recommended by manufacturer for use intended.

### 2.02 COUNTERTOPS

- A. Countertops and Edging: [3/4" B-C particleboard (except at sinks, use exterior grade plywood only)] [Fire-retardant particle board] with plastic laminate bonded to tops.



1. In locations as required by local codes or ordinances, provide fire retardant countertop assemblies, as tested in accordance with ASTM E 84.
- B. Plastic Laminate Work:
  1. Where shown as self edged, countertops shall have 3/4" x 4" high square-edged separate matching backsplash and matching aprons with same grade of laminate as top surface unless indicated otherwise.
    - a. Apply trim and edging prior to surface sheet.
    - b. Apply veneers or plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline. Locate counter butt joints minimum 2 feet from sink cut-outs.
  2. Counters and work tops with sinks: Substrate for back splashes and at edges shall be trimmed lumber. Use only exterior grade or marine grade Plywood near wet areas. All adhesives used near water shall be formulated to be specially water-resistant.
- C. ADA Accessible Guest Room:
  1. Meet all local and national requirements for access. Minimum work surface shall be as follows:
    - a. Sink Area: Minimum 28" to 34" maximum above finished floor x 30" in length.
    - b. Countertop: Minimum 28" to 34" maximum above finished floor x 30" in length.
  2. For units which have exposed sides and ends due to placement of accessible units, provide durable, nonabsorbent materials for finish.
  3. Provide wall brackets and standards of the type capable of loads of 250 pounds per linear foot of horizontal work surface.
  4. Provide brackets capable of supporting work surfaces and loads without leading edge deflection greater than 1/2".

## **2.03 INSTALLATION MATERIALS**

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

## **2.04 FABRICATION**

- A. General:
  1. Shop assemble countertops for delivery to site in units easily handled and to permit passage through building openings.
  2. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trip for scribing and site cutting.
  3. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings.

## **EXECUTION**

### **3.01 INSPECTION**

- A. Verify adequacy of backing and support framing.

### **3.02 INSTALLATION**

- A. All countertops and shelving shall be installed as shown on Drawings and as specified by manufacturer.
- B. Set and secure countertops in place rigid, plumb, and level.
- C. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
- D. Fasteners:

1. Use purpose designed fixture attachments at concealed locations for wall-mounted components.
2. Use threaded steel concealed joint fasteners to align and secure adjoining counter tops.
3. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

### **3.03 PLASTIC LAMINATE**

- A. Installation:
  1. The plastic laminate shall be bonded to a suitable substrate. Rigid setting type adhesive is recommended. The temperature of the materials, surfacing, substrate, and adhesive, and the area in which the actual fabrication is to be done shall not be less than 65 degrees F. with a relative humidity of not less than 35% and not more than 85%. All inside corners of cutouts in plastic laminate shall be radiused as large as possible with 1/8"R minimum. File edges of the radius smooth and free of cracks and crazes.
- B. Method:
  1. Assembly of components should be accomplished using approved procedures, materials, and equipment, and the workmanship should conform to established industry practices, conditions, procedures, and recommendations.
- C. Use single sheet at corners. Seams will not be permitted at corners, unless otherwise approved by [Architect] [Owner's Representative].
- D. Arrange joints in vertical edges away from common view.

### **3.04 ADJUSTING AND CLEANING**

- A. Clean surfaces of plastic laminate with a damp cloth or ordinary bar soap and water. Harsh abrasive cleansers shall not be used. Stubborn dirt may be removed with lacquer thinner, methylethyl Ketone, contact adhesive solvents or cleaner waxes.

**END OF SECTION**

**SECTION 12 36 61**  
**SOLID SURFACING COUNTERTOPS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Solid Surfacing
    - a. Countertops.
    - b. Window Stools (Sills)
- B. Related Sections:
  - 1. Section 06 10 00 (06100) - Rough Carpentry
  - 2. Section 06 20 00 (06200) - Finish Carpentry
  - 3. Section 12 30 00 (06400) - Architectural Woodwork
  - 4. Section 12 36 61 (09385) - Simulated Stone Countertops
  - 5. Section 12 36 61.13 (06610) - Cultured Marble Countertops
  - 6. Division 22 (15) for Plumbing Fixtures

**1.02 REFERENCES**

- A. American National Standards Institute (ANSI) Publications:
  - 1. Z124.3 "Plastic Lavatories"
- B. ASTM International (ASTM) Publications:
  - 1. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
- C. Architectural Woodwork Institute (AWI) Publications:
  - 1. "Architectural Woodwork Quality Standards"
  - 2. AWI Section 400 "Architectural Cabinets"
- D. Federal Specifications (FS) Publications:
  - 1. MMM-A-130 "Adhesive, Contact"
- E. The International Solid Surface Fabricators Association (ISSFA) Publications:
  - 1. Specification ISSFA 2-0

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit Shop Drawings and product data. Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes.
    - a. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

**1.04 QUALITY ASSURANCE**

- A. [Lavatory/vanity] countertops [and window stools] shall be supplied by one manufacturer. Color shall match for all items. Refer to Interior Finish Index.
- B. Allowable Tolerances:
  - 1. Variation in component size: +/- 1/8 inch.
  - 2. Location of openings: +/- 1/8 inch from indicated location.
- C. Perform work to (custom) quality in accordance with "Quality Standards" of the Architectural Woodwork Institute (AWI).
- D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or,

where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver solid surfacing until painting and similar operations that could damage solid surfacing materials have been completed in installation areas. If solid surfacing must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

#### **1.06 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install solid surfacing until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where solid surfacing is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support solid surfacing work by field measurements before being enclosed and indicate measurements on Shop Drawings.

### **PRODUCTS**

#### **2.01 SOLID SURFACING MATERIALS:**

- A. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.
  - 1. Manufacturers:
    - a. Countertops:
      - 1) None
    - b. Window Stools:
      - 1) None
  - 2. Approved Manufacturers:
    - a. Countertops:
      - 1) "Corian"; Dupont (800-426-7426)
    - b. Window Stools:
      - 1) "Corian"; Dupont (800-426-7426)
      - 2) "Sultra"; One Source Group (478-987-3185)
- B. Fire Hazard Ratings:
  - 1. Classified in accordance local codes and ordinances, ASTM E84 and the following:
    - a. Class [A] [ I ] [C] [ III ]
    - b. Flame Spread: [Class A: 0 - 25] [Class I: 0 - 25] [Class C: 76 - 200] [Class C: 76 - 200]
    - c. Smoke Developed: 0-450
- C. [Window Stools and] Countertops:
  - 1. Homogeneous solid surface countertops [and window stools]. Thickness, sizes and profiles as shown on Drawings. Color and Finish as shown on Interior Finish Index.
    - a. Provide matching backsplash, sidesplash, aprons, shelves, and other accessories as shown on Drawings in same material, color and finish as countertops.
    - b. If shown on Drawings, apron shall be prepared to receive facial tissue dispenser as detailed on the Drawings.

## **2.02 INSTALLATION MATERIALS**

- A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- B. Sink/Lavatory Mounting Hardware: Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.
- C. Adhesive and Sealant as recommended by solid surfacing manufacturer.

## **2.03 FABRICATION**

- A. General:
  - 1. Fabricate tops in one piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
  - 2. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
    - a. Rout and finish component edges with clean, sharp returns. Rout cutouts, radii and contours to template. Smooth edges. Repair or reject defective and inaccurate work.
  - 3. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trip for scribing and site cutting.
  - 4. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings.

## **EXECUTION**

### **3.01 INSPECTION**

- A. Verify adequacy of backing and support framing.

### **3.02 PREPARATION**

- A. Condition solid surfacing to average prevailing humidity conditions in installation areas before installation.

### **3.03 INSTALLATION**

- A. All countertops, [, and window stools], shall be installed as shown on Drawings and as specified by manufacturer.
- B. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
- C. Adhere sinks and lavatory bowls to tops using manufacturer's recommended sealant, adhesive and mounting hardware.
- D. Countertops:
  - 1. Quality Standard: Comply with AWI Section 400 requirements for countertops.
  - 2. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
  - 3. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 4. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 5. Provide cutouts in panel required for the installation of plumbing outlets.
  - 6. Adhere sinks and lavatory bowls to tops using manufacturer's recommended sealant, adhesive and mounting hardware.
  - 7. Provide backsplashes, sidesplashes, and aprons as indicated on the Drawings. Adhere to tops using manufacturer's recommended adhesive.

### **3.04 ADJUSTING AND CLEANING**

- A. Keep components clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained and damaged components.
- B. Protect surfaces from damage until Date of Substantial Completion. Repair work or replace damaged work which cannot be repaired to Owner's Representative's satisfaction.

**END OF SECTION**

**SECTION 12 48 13**  
**ENTRANCE FLOOR MATS AND FRAMES**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Frames to be set in concrete floors to receive recessed floor mats
  - 2. Recessed floor mats of the following type:
    - a. Carpet-type mats
- B. Related Sections:
  - 1. Division 03 Sections for concrete work, including forming, placing, and finishing concrete floor slabs and grouting frames into recess.

**1.02 REFERENCES**

- A. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)
  - 1. B221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes"
  - 2. D2047 "Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine"
  - 3. E648/NFPA 253 "Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source"

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product data for each type of floor mat and frame specified, including manufacturer's specifications and installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.
  - 2. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual sections of floor mat and frame materials, showing full range of colors, textures, finishes, and patterns available, for each type of floor mat and frame indicated.
  - 3. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats.

**1.04 QUALITY ASSURANCE**

- A. Single Source Responsibility: Obtain floor mats and frames from one source of a single manufacturer.
- B. Flammability in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45watts/m2.
- C. Slip resistance in accordance with ASTM D2047, Coefficient of Friction, minimum 0.60 for accessible routes.

**1.05 PROJECT CONDITIONS**

- A. Field measurements: Check actual blocked-out openings in floors by accurate field measurements before fabricating frames and mats show recorded measurements of final shop drawings. Coordinate fabrication schedule with construction progress to avoid a delay of the Work.

**1.06 SEQUENCING AND SCHEDULING**

- A. Install mat frames integrally with principal pour of concrete floor system. Locate, align, and level frame members accurately, but recess in-fill by at least 1" for placement of concrete topping promptly after principal pour has hardened.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Recessed Floor Mats:
  - 1. Preferred Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Pedimat - Model M1HCRM9303HM / MFALTANGM", Grand Entrance, A Division of Construction Specialties, Inc. (888-424-6287) (
    - b. Approved Substitution by; Balco USA (800-767-0082)
- B. Materials:
  - 1. Carpet Tread Inserts: Unitary fusion bonded nylon with a pile height of 1/4" and a minimum yarn weight of 30 ounces per square yard.
    - a. Carpet shall meet the Carpet and Rug Institute's standard for indoor air quality. 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.
    - b. Color: Refer to Interior Finish Index
  - 2. Tread Rails:
    - a. Materials:
      - 1) Vinyl/Acrylic: High-impact PVC alloy.
      - 2) 6063-T5 aluminum alloy per ASTM B221.
    - b. Finish: M-M12C22A42, Class 1 anodized, color as shown on Interior Finish Index.
    - c. Spacing: 2" on center, connected by vinyl hinge
  - 3. Recess-Mounted Aluminum Tapered Angle Frame:
    - a. Material: 6063-T5 aluminum alloy
    - b. Finish: M-M12C22A42, Class 1 anodized, frame color as shown on Interior Finish Index.
      - 1) Mill finish frames in contact with concrete shall be primer coated.
    - c. 1/2-inch deep recess.

### 2.02 FABRICATION

- A. Shop-fabricate units of floor mat work to greatest extent possible in sizes as indicated. Where not indicated otherwise, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints. Where possible, verify sizes by field measurement before shop fabrication.

## EXECUTION

### 3.01 INSTALLATION

- A. Install recessed frames and mats complying with manufacturer's instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

### 3.02 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses, and cover frames with plywood flooring. Maintain protection until construction traffic has ended and Project is near time of Substantial Completion.
- B. Defer installation of floor mats until time of Substantial Completion for Project.

## END OF SECTION



**SECTION 13 11 00**  
**SWIMMING POOLS - INDOOR**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Pool Constructed of Gunite and Shotcrete System.
    - a. The Pool Contractor shall be responsible for design and installation of indoor pool system.
  - 2. Pool Contractor shall be responsible for submitting and securing necessary approvals and permits, including payment of fees, and expenses for the preparation of any required documentation.
- B. Related Sections:
  - 1. Section 07 92 00 (07920) - Joint Sealants
  - 2. Section 09 30 00 (09310) - Tiling
  - 3. Division 22 (15) and 26 (16) Specifications for the following:
    - a. Excavation for electrical and plumbing lines.
    - b. Pool deck hose bibs.
    - c. Cold water supply within pool equipment room.
    - d. Gas line for pool heaters.
    - e. Conduit wiring, receptacles and disconnects to the pool equipment room.
    - f. Pool heater flues.
    - g. Filter room, decks, sealing of joints between pool and deck, shall be provided as work of other sections.
    - h. Connection of floor & deck drains and hose bibs is specified in Division 22.
    - i. Connection of pool heater to gas source and heater vent piping in equipment room shall be performed by Contractor.
    - j. Provisions for combustion air.
    - k. Connection of automatic water fill system and fill spout cold water lines from water source in equipment room is specified in Division 22.
    - l. Connection of all pool equipment, starters and switches; grounding of pool, pool equipment, pool lights and niches, and wiring of pool & lights from electrical panel in equipment room is specified in Division 26.
    - m. On Projects that include emergency generator, the underwater pool niche lights shall be connected to emergency power.
  - 4. Section 31 20 00 (02300) - Earthwork
  - 5. Section 33 10 00 (02500) - Utility Services

**1.02 REFERENCES**

- A. Applicable requirements of the following Specifications and Codes apply to work of this Section:
  - 1. Local building and health codes.
  - 2. American National Standards Institute (ANSI) Publications:
    - a. ANSI/APSP-1 "Standard for Public Swimming Pools"
    - b. ANSI/APSP-7 "American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins"
    - c. ANSI/APSP-11 "Standards for Water Quality in Public Pools and Spas"
  - 3. American Society for Testing and Materials (ASTM): Publications
    - a. A615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"
    - b. C33 "Standard Specification for Concrete Aggregates"
    - c. C150 "Standard Specification for Portland Cement"
  - 4. American Society of Mechanical Engineers (ASME) Publication
    - a. "Coding and Labeling"
  - 5. Gunite Contractors Association (GCA): Publication

- a. G-84, "Guniting and Shotcrete"
- 6. Association of Pool & Spa Professionals (APSP)
- 7. National Fire Protection Association (NFPA) Publication:
  - a. 70 "National Electric Code"
- 8. National Sanitation Foundation (NSF): Seal of approval program.
- 9. Tile Council of America, Inc. Publication
  - a. "Handbook for Ceramic Tile Installation".

### 1.03 SYSTEM DESCRIPTION

- A. System shall include:
  - 1. Provide systems of fully compatible components and construction methods required for complete and operable systems for indoor swimming pool including but not limited to excavation, dewatering of construction area and removal of excess earth from site.
  - 2. Guniting and shotcrete shell.
    - a. Finish Plaster Mix (Diamond Rite).
  - 3. Excavating, hauling, backfilling, grading and incidental earthwork in conjunction with the construction of the swimming pool.
    - a. Handle and dispose of excess material, regardless of type, character, or composition.
  - 4. Connections of water and gas to pool equipment.
  - 5. Connection of motors, pumps, compressors, switches and timers, lights, and wiring necessary for interfacing of equipment.
  - 6. Pool Equipment.
    - a. Filter Systems
    - b. Flow Meters
    - c. Water Treatment Systems
    - d. Heaters
    - e. Recirculation Pumps and Motors
    - f. Piping
    - g. Fittings, Lights and Accessories
    - h. Deck Drain System
      - 1) Automatic Water Fill System and Fill Spout
  - 7. All pools including equipment, shall be designed and constructed to avoid entrapment of clothes, hair and people and shall comply with the U.S. Pool Safety Act (Virginia Graeme Baker Pool Safety Act) and ANSI/APSP-7 "American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins".

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data:
    - a. Manufacturer's technical literature with installation and storage instructions for each product specified.
    - b. Pumps: Pump performance curves indicating GPM vs. TDH, maximum efficiency point, and maximum amperage draw, together with current characteristics and service factor of motor.
- C. Shop Drawings
  - 1. Submit the following Shop Drawings to the [Architect][Owner's Representative] for approval:
    - a. Complete design of swimming pool, including all component parts, attachments, devices, or other work, filtration filter, size, turn-over capacity, and supporting calculations.
    - b. Foundation plan and details and Sections through pool shall be included.

- c. Mechanical schematic.
  - d. Detail for ladder and pool wall interface.
- 2. Show all shop erection details.
- 3. All Shop Drawings shall be certified and sealed by a Professional Engineer, registered in the state in which project is being submitted.
- 4. The pool manufacturer shall certify to the Owner that the depth and configuration of the pool is acceptable and compatible with all known safety standards for the manufacturer's designed product.
- D. Samples:
  - 1. Precast concrete pool coping deck and in pool deck, One-12" long section of coping, complete with stenciled depth marking.
  - 2. Submit three (3) samples of each type and color of tile required.
- E. Quality Control:
  - 1. Design Data:
    - a. Hydraulic analysis: Engineer's sealed calculations and total dynamic head (TDH) for swimming pool system for equipment other than that specified.
    - b. Structural analysis: Engineer's sealed calculations and analysis for pool concrete design.
- F. At the completion of the work, the Pool Contractor shall furnish to the Owner two bound copies of an operation manual. Minimum content of these manuals shall be:
  - 1. Operating Instructions
  - 2. Equipment Literature with Parts List of all Equipment
  - 3. Water Chemistry Procedures
  - 4. Suggested Safety Procedures
  - 5. Repainting/Refinishing Procedures
  - 6. Include chemical analysis of source/make-up water supply
  - 7. Copies of all manufacturer's warranties
  - 8. Test reports
  - 9. Sealed Engineer's drawings.
  - 10. Certificates: From local authorities indicating that pool construction and performance conform to requirements of respective authorities.

## **1.05 QUALITY ASSURANCE**

- A. All work under this Section must be performed by a Contractor experienced and regularly engaged in building, commercial swimming pools. Contractors bidding this work must have completed five (5) projects within the past ten years equal to or larger than this project.
- B. Pool specification and related pool drawings are to be considered as performance guidelines only meeting minimum requirements which may change as result of local code and health department requirements.
  - 1. The project Drawings and Specifications supplement each other. In the event of a conflict, the Specifications shall govern. Piping locations are schematic. Precise locations of piping shall be determined by actual field condition. Fittings are not shown. The Pool Contractor shall include all fittings normally required for a completed system.
  - 2. This Contractor shall be responsible for reviewing the complete set of Contract Documents and coordinate work with other trades.
- C. All work under this Section shall be inspected and installed in accordance with all current local and state codes and regulations.
  - 1. The Pool Contractor shall obtain the following:
    - a. Board of Health Design Approvals
    - b. State Board of Health Inspections and Final Approval
    - c. Structural and Electrical Inspections and Final Approvals on his Portion of the Work
- D. The standards of these Plans and Specifications are intended to provide the Owner with a low maintenance pool.

- E. Pool Contractor to be responsible for design and installation of pools, including layouts, routing of piping, as well as the proper location and quantities of required accessories. Responsibilities also include necessary valves, devices, and controls for pool system as required.
- F. Contractor's design drawings must be sealed and signed by a licensed Engineer registered in State in which project is being constructed.
- G. Contractor shall submit, on his letterhead, a list of all variations and deviations he finds that differ between local code requirements and bid drawings.
- H. At the completion of the work, the Pool Contractor shall fill the pool with water and instruct the Owner's operating personnel in the operation of all equipment.

## **1.06 PROJECT CONDITIONS**

- A. Coordination: Coordinate this work with the work of other Sections to avoid any delay or interference with other work.
  - 1. Filter room, decks, sealing of joints between pool and deck, fencing and landscaping shall be provided as work by other Sections.
  - 2. Connection of all pool equipment, starters and switches; grounding of pool, pool equipment, pool lights and niches, and wiring of pool lights shall be performed by Pool Subcontractor from electrical panel in equipment room.
  - 3. Connection of floor drains, deck drains and hose bibs shall be provided as work of other Sections.
  - 4. Connection of pool heater to gas source and heater vent piping in equipment room shall be performed by [Pool Subcontractor] [Mechanical Contractor].
  - 5. Provisions for combustion air will be provided as work by other Sections.
  - 6. Connection of automatic water fill system and fill spout cold water lines from water source in equipment room shall be performed by Pool Subcontractor.
- B. Lines, Grades, and Elevations:
  - 1. The General Contractor shall establish a bench mark for elevations and control points for measurements and layouts. The Pool Contractor shall be responsible for lines, grades, and measurements from these points required for the installation of the pool.
- C. Utilities:
  - 1. The Contractor shall supply the water required for construction and filling and testing of the pool from permanent accepted system.
- D. The Pool Contractor shall test the Owner's natural water supply and furnish and supply start-up chemicals as required for start-up, including chlorine and requirements to balance total alkalinity and calcium hardness, and shall obtain same.

## **1.07 WARRANTY**

- A. The Pool Contractor shall warranty his work against defects in labor and equipment, including paint, for a period of one year from Substantial Completion. Substantial Completion shall be defined as the date of acceptance by the Owner or initial usage, whichever occurs first. This warranty shall not include minor defects that do not affect the use of the pool such as scratches, minor dents, or concrete curing cracks.

## **PRODUCTS**

### **2.01 MANUFACTURERS: THE FOLLOWING MANUFACTURERS ARE APPROVED FOR USE AS IDENTIFIED IN THE INDIVIDUAL PARAGRAPHS BELOW:**

- A. Manufacturers:
  - 1. None
- B. Approved Manufacturers:
  - 1. A & B Brush
  - 2. Action/Haviland (800-333-0400)
  - 3. American Olean Tile Co. (800-933-8453)
  - 4. American Products

5. Anchor Industries, Inc. (800-544-4445)
6. Aqua Creek Products (888-687-3552)
7. Berkeley (Sta-Rite Water Systems) ( 888-237-5353)
8. Bio-Lab, Inc. (800-959-7946)
9. Blue White Industries (714-893-8529)
10. Cal-June, Inc. (818-761-3516)
11. Dal-Tile Corp. (800-933-8453)
12. Federal Stone Industries, Inc. ( 800-513-5030)
13. Frost Co. (Inter-Fab) (800-737-5386)
14. A. J. Giammanco & Associates, Inc. (Lion Pool Products) (800-546-6766)
15. Gould Pumps, Inc (315-568-2811)
16. Grace Construction Products (800-778-2880)
17. Guardex (Bio-Lab) (800-959-7946)
18. Halogen Supply (800-777-7946)
19. Hydrotech (Bio Lab). (800-795-7946)
20. Inlays Inc. (800-426-6873)
21. Jandy (707.776.8200)
22. Lochinvar Corp. (615-889-8900)
23. Mameco International, Inc.; a Division of Tremco, Inc. (800-321-6412)
24. Mec-O-Matic (Pulsafeeder) (800-333-6677)
25. Mortex Manufacturing, Inc. (800-338-3255)
26. Omni (Div. Bio-Lab) (800-959-7946)
27. PAC-FAB, Inc. (see Paragon Aquatics) (800-983-7665)
28. Paragon Aquatics, a Division of Pentair, Inc. (845-463-7200) .
29. Pentair Pool Products (800-843-5628)
30. Purex (see Pentair Products)
31. Quaker Plastic Corporation (888-288-6644)
32. Rainbow, a Brand of Pentair, Inc. (800-831-7133)
33. Raypak, Inc (818-889-1500)
34. George Fischer Signet Scientific Co. (800-854-4090)
35. S.R. Smith, LLC (800-824-4387)
36. Spectrum Products (800-791-8057)
37. StaRite Pool and Spa Group a Pentair Company (800-843-5628)
38. Stenner
39. Swimquip (See Sta-Rite Pool Spa Group) (800-752-0183)
40. Taylor Technologies. (800-837-8548)
41. Telodyne Laars (415-382-8220)
42. Whitten (Aquatic Development Group) (518-783-0038)
43. W. R. Meadows, Pool Deck Construction Products (800-542-7665)
44. VAK PAK (800-877-1824)

## **2.02 POOL STRUCTURE - GENERAL**

- A. Size of pool shall be as shown on Drawings.
- B. Joint sealant shall be polyurethane, Mameco Vulkem No. 45.
- C. Ceramic Tiling: Tile used in conjunction with surfaces in contact with water shall be furnished and installed by pool Contractor.
- D. Perimeter and general purpose sealants shall be polyurethane, refer to Section 07 92 00 (07920)

## **2.03 POOL MATERIALS**

- A. Concrete:
  1. Definitions:

- a. Gunitite: Dry-mix. Originally a trade name used to designate a mixture of Portland cement and sand thoroughly mixed dry, passed through a cement gun and conveyed by air through a flexible tube, hydrated at the nozzle and placed by air pressure.
    - b. Shotcrete: Wet-mix. transit-mix (ready-mix) combination of Portland cement, aggregates and water, pumped in a plastic state to the nozzle, where air is added to place the material.
  2. Materials and mixes for "Gunitite" and shotcrete shall conform to GCA publication G-84.
  3. Gunitite:
    - a. Aggregate: ASTM C33, washed sand; clean, hard, sharp particles, well graded in size within the following limits:
      - 1) Percent by Weight
      - 2) Passing through 3/8 inch screen 100
      - 3) Passing through No. 4 95 to 100
      - 4) Passing through No. 8 65 to 90
      - 5) Passing through No. 16 45 to 75
      - 6) Passing through No. 30 30 to 50
      - 7) Passing through No. 50 10 to 22
      - 8) Passing through No.100 2 to 8
    - b. Mix one part cement to 4 1/2 parts of sand based on dry, loose volume (minimum 3,000 psi compressive strength in 28 days).
    - c. Portland cement and water: As specified hereinafter.
  4. Shotcrete:
    - a. Transit mix (ready-mix) materials conforming to aggregate specified above for "Gunitite" and with the additional following grading for pea gravel:
      - 1) Sieve Size Percent by Weight
      - 2) 100
      - 3) 90
    - b. Mix Strength: Minimum 5,000 psi compressive strength in 28 days.
    - c. Submit design mix and certify material for weight, water content and mixing time.
    - d. Portland Cement and Water: As specified hereinafter.
  5. Portland Cement: ASTM C150, Type I or II.
  6. Water: Potable.
  7. Forms: Exterior plywood, APA-B8 Plyform Class 1, mill-oiled.
  8. Form Oil: Lacquer or resin type compatible with mill-oil.
  9. Reinforcing Steel: ASTM A615 grade 40.
  10. Gauging Wires: Piano wire, 0.027" thick.
- B. Ceramic Tiling:
1. [Refer to Interior Finish Index]
  2. Unglazed Ceramic Mosaic tile at Step Nosings:
    - a. Manufacturers:
      - 1) None
    - b. Approved Manufacturers:
      - 1) Dal-Tile Corp
      - 2) American Olean Tile Co.
  3. Provide certification by manufacturer for use in indoor pools.
  4. Pool Tile: [Refer to Drawings and Interior Finish Index for size and location] [2" x 2"] [3" x 3"] at water line below coping cap.
  5. [2" x 2"] [3" x 3"] non-slip unglazed ceramic mosaic tile in color as shown in Interior Finish Index at step nosings forming a [2"] [3"] horizontal and [2"] [3"] vertical band. Refer to Interior Finish Index.
  6. Special Tiles:
    - a. Manufacturers:
      - 1) None
    - b. Approved Manufacturers:

- 1) Inlays Inc. (800-426-6873)
7. Pool Depth Markings: 6" x 6" tile with 4" high lettering depth marking in both feet and meters for skim line (smooth) and deck (non-slip), as required by local and state public swimming pool codes.
  - a. Numbers with Small FT and Small M Tiles: "Ceramic FT & MDM Series"; Inlays Inc.
8. No Diving Sign Tile: Adjacent to each depth marker, provide international symbol "No Diving" sign tile. "No Diving" tile shall be 6" x 6" for skim-line and 6" x 6" for deck (non-slip) white ceramic with black lettering and markings and a red circle with cross hatch, as required by local and state public swimming pool codes.. Where shown on Drawings, provide 6" x 12" tile with 4" high lettering with text "NO DIVING".
  - a. International Symbol No Diving Tiles: "Ceramic MG Series"; Inlays Inc.
  - b. Letters Only Tiles "No Diving": "Ceramic TMG Series"; Inlays Inc.
9. Depth marking and no diving tiles shall be placed on the vertical pool walls as part of the 6" tile band below the coping so as to be easily readable from the water side. Depth marking and "No Diving" tiles on the horizontal surface of deck, shall be within 18" of the water edge and positioned to be read while standing on the deck facing the water. Pool markings shall be placed at maximum and minimum depths, all points of slope change, at every one foot of depth increment, and at major deviations in shape. Markers shall be spaced at no more than 10 foot intervals and arranged to be uniformly located.
10. Tile Mortar and Grout: As specified in Section 09 30 00 (09310) - Tiling.
11. Refer to Interior Finish Index for colors.
- C. Finish Plaster Mix:
  1. White marble, White waterproof cement and bonding agent.
  2. Manufacturers:
    - a. None
  3. Approved Manufacturers:
    - a. "Diamond Brite" Pool Finish; SGM (Southern Grouts & Mortars, Inc.) (800-641-9247)
    - b. No Substitutions
  4. Finish and Color: Selected by Owner's Representative
- D. Sealant and Back-Up Material: See Section 07 92 00 (07920) - Joint Sealants
- E. Precast Concrete Pool Coping:
  1. Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Model DQ"; Federal Stone Industries, Inc. (301-271-7121)
    - b. Approved Substitution
  3. Precast concrete, wet pour, white, 12-inches wide x minimum 2-feet long, safety hand grip style, raised safety edge, coping stone with raised slip resistant pattern on upper surface. Provide one-piece radius corners.
  4. Provide bonding coat as recommended by finish manufacturer.

## 2.04 FILTER SYSTEM

- A. Pressure Filters:
  1. Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. Paragon Aquatics, a Division of Pentair, Inc. (845-463-7200)
    - b. StaRite Pool and Spa Group a Pentair Company (800-843-5628)
    - c. Approved Substitution
  3. Filter systems: Listed as approved by the National Sanitation Foundation for sand filters at flow rates of 20 GPM per square foot of filter area, and bear the National Sanitation Foundation Seal of Approval. Maximum filter flow rate shall not exceed 15 GPM per square foot of filter area.
  4. Filter or Filter Battery Stainless steel or fiberglass hi-rate pressure sand filters.

5. Include with each filter top mounted influent pressure gauge, reading 0 to 60 psi, manual air release valve, multi-port diameter valve, backwash site glass and transparent dome top.
- B. Filter Media: Sand, with an effective size of 0.45 to 0.55 mm with uniformity coefficient of 1.6 maximum.
- C. Filter Face Piping:
  1. Pipe, valves, and fittings shall make a complete unit or battery from inlet to outlet.
  2. Arrange piping to carry out operations of filtering, backwashing and by-pass of filter for pool draining.
  3. Face pipe and fittings: PVC SCH 40.

## 2.05 FLOW METERS

- A. Flow Meter:
  1. Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. Paragon Aquatics, a Division of Pentair, Inc. (845-463-7200)
    - b. StaRite Pool and Spa Group a Pentair Company (800-843-5628)
    - c. "CF-300 Series; Blue White Industries, pilot tube type.
    - d. Approved Substitution by Signet Scientific Co.

## 2.06 WATER TREATMENT SYSTEM

- A. Chemical Feeder by Owner.
- B. Chemical Feeder:
  1. Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "Model 25163000"; Hydrotech
    - b. Approved Substitution by Omni
    - c. Approved Substitution by Guardex
    - d. Approved Substitution
  3. Include in-line flow meter, flow control valve, clear dome top and shut-off valves on both sides of feeder.
  4. Quantity: one at pool.
- C. Chemicals:
  1. Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "SpaBrom" bromine sticks - Hydrotech 20 lb.
    - b. Approved Substitution.
- D. Test Kit:
  1. Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. "#K-1744-H"; Taylor Technologies
    - b. "#26122000"-"Guardex" Bio-Lab.
    - c. Approved Substitution

## 2.07 POOL HEATERS

- A. Pool Heaters:
  1. Manufacturers:
    - a. None
  2. Approved Manufacturers:
    - a. Telodyne Laars (415-382-8220)



- b. Raypak, Inc (818-889-1500)
  - c. Approved Substitution.
- B. Heaters:
  - 1. Size for pool as shown on the Drawings, complete. Design based on maintaining a temperature of 80 degrees F for pool.
  - 2. Heaters must be A.S.M.E coded and labeled.
- C. Furnish in-line thermometer with 2 degrees F. intervals and a minimum range of 60-120 degrees F.

## 2.08 RECIRCULATING PUMP AND MOTOR

- A. Pumps:
  - 1. Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. Paragon Aquatics, a Division of Pentair, Inc. (845-463-7200)
    - b. StaRite Pool and Spa Group a Pentair Company (800-843-5628)
    - c. Approved Substitution
  - 3. Self priming unit with hair and lint strainer capable of delivering the designated GPM at the designated head during the filtering operation without overloading along the full length of the pump curve.
- B. Pump Motors:
  - 1. Energy efficient, UL listed "E-plus Century"; Gould Pumps, Inc.
  - 2. Electrical Characteristics: As shown on Drawings

## 2.09 PIPING

- A. Piping within filter room: Polyvinyl chloride (PVC), Type 1-1220, Schedule 40 IPS, Class #135. N.S.F. approved and labeled.
- B. Pool fill line: Schedule K copper.
- C. Filtered water supply piping to pool: Schedule 80 PVC. N.S.F. approved.
- D. Filter connection piping which connects the filter plant to the filter pump and to the recirculation piping, backwash piping and other piping associated with filter system: PVC, Type 1-1220, Schedule 40 IPS, Class #135. N.S.F. approved and labeled.
- E. Fittings for PVC pipe: Whenever PVC pipe is used, all fittings shall be heavy weight, Schedule 40, of same manufacture as PVC pipe used.
- F. NOTE: The first 24" of piping coming from pool heater shall be copper. Where the copper connects to PVC piping, after the 24", provide a copper to PVC transition connection.
- G. Valves:
  - 1. Small Valves (up to and including 2-1/2" in size): Gate valves, all brass with threaded ends for ferrous pipe, 125 lb. non-rising stem type.
  - 2. Large valves (larger than 2-1/2"): Rubber lined, cast iron, water type butterfly valves. Valves shall be hand operated with cadmium plated ductile iron discs, stainless steel stems and pins, and Buna-N seats and rated for 125 psi.
  - 3. Valve extension stems and keys: Provide as required to operate the system.
  - 4. Pipe identification: Plastic tags for valves in filter room.
- H. Pipe Joints:
  - 1. Cement and thinners: Use for making solvent welded joints. Of type compatible with kind of piping used.
  - 2. Teflon tape (.003" min thickness): Use on the male threads of threaded pipe joints.
- I. Fillers and levelers: Provide instrumentation sensors and valves to automatically fill and maintain level of pool complete with wiring and controls.

- J. Chemical feed and heater controls: Provide instrumentation sensors and valves to automatically feed chemicals and maintain temperature of pool complete with wiring and controls.

## 2.10 SCHEDULES OF POOL FITTINGS' LIGHTS AND EQUIPMENT ACCESSORIES

<u>DESCRIPTION</u>	<u>MANUFACTURER</u>	<u>MODEL NUMBER</u>
A. POOL FITTINGS		
1. FLOOR INLET	FROST	A-41014
2. POOL WALL INLET	SWIMQUIP	8429
3. AUTO WATER LEVEL CONTROL	MAR-MAX	LTC 0024S
4. 1-1/2" HYDROSTAT VALVE	FROST	A-41452
5. 1-1/2" HYDROSTAT TUBE	SWIMQUIP	7017-157
6. 1-1/2" SKIMMER	AMERICAN PROD	844201
7. 1" FILL SPOUT	FROST	A-41240
8. POOL MAIN DRAIN SUMP	SWIMQUIP	7017-0103
9. POOL MAIN DRAIN GRATE	SWIMQUIP	7010741
B. UNDERWATER LIGHTS: (COORDINATE WITH SECTION 16510(26 51 00))		
1. 100W/300W/12V LIGHT (TWO)	PAC-FAB	PHL-301/PHL-300
2. LIGHT NICHE	PAC-FAB	425.4
C. DECK FITTINGS:		
1. GRAB RAIL, 1.90-1/2" OD X .065 STAINLESS STEEL WITH SMOOTH GRIP FINISH	S. R. SMITH	
2. DECK ANCHOR	S. R. SMITH	AS-100B
3. ESCUTCHEON PLATE	S. R. SMITH	IEP-100
4. LADDER 3 TREAD 1.90" OD X .065" STAINLESS STEEL WITH MIRROR FINISH. PROVIDE EVERY 75' AT PERIMETER	S. R. SMITH	SRS 506
D. MAINTENANCE ACCESSORIES:		
1. VACUUM CLEANER HEAD SWIVEL WHEEL	RAINBOW	FLEX-A-VACUUM
2. VACUUM HOSE HEAVY DUTY	ACTION/HAVILAND	1-1/2" X 35'
3. VACUUM POLE (TELESCOPIC 8' TO 16')	RAINBOW	#812-16 (8'-16')
4. UTILITY POLE	FROST	A40177-2
5. 18" CURVED WALL BRUSH	A&B BRUSH	3000
	SPECTRUM	13210
6. ALGAE BRUSH	A&B BRUSH	2004
	SPECTRUM	13260/13270
7. POLE ADAPTER	FROST	A-41420 W/BRASS BOLTS & WING NUTS
8. DECK SWAB	HALOGEN SUPPLY	48" CR RUBBER
9. BRUSH STABILIZER	A&B BRUSH	WATER FOIL
E. SAFETY ACCESSORIES:		
1. LIFE BUOY (24" APPROX.)	CAL-JUNE, INC.	U.S.C.G.
2. THROW LINE W/ FLOATING BALLS (VERIFY THAT MINIMUM LENGTH OF LINE IS EQUAL TO WIDTH OF POOL)	AJ GIAMMANCO	[60']
3. LIFE HOOK	RAINBOW	#153 DOUBLE ARM (R221026/R221030)
4. LIFE HOOK POLE	RAINBOW	820-16 (R191116)

5. LIFE HOOK POLE ADAPTER

FROST

A-14420 W/BRASS  
BOLTS AND WING  
NUTS

6. 16 UNIT FIRST AID KIT

## 2.11 DECK DRAIN SYSTEM

- A. Deck Drain System.
  - 1. Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. "Deck-O-Drain", W. R. Meadows, Pool Deck Construction Products (800-542-7665)
    - b. "Deck Drain-A-Way System II", Quaker Plastic Corporation (888-288-6644)
    - c. "Drain Rite" Mortex Manufacturing (800-338-3255)
    - d. Approved Substitution
- B. Material:
  - 1. Heavy wall, bondable, non-corrosive PVC
  - 2. Provide all nailing clips, couplers and fittings, end adapters, clean-out plugs and protective tape over drain surface.
- C. Size: +/- 1-1/2" x 3-1/4" high x min. 8 ft. lengths, Center Channel.
- D. Color: As selected by Owner's Representative

## 2.12 ADA ACCESSIBLE LIFT

- A. Accessible Lift:
  - 1. Manufacturers:
    - a. None
  - 2. Approved Manufacturers:
    - a. Hydraulic Powered, Fixed Lift: "Swim-Lift Model Gallatin - ADA Handicap Pool Lift"; Spectrum Aquatics (800-791-8057) including the following accessories:
      - 1) 400 lbs weight capacity
      - 2) "Preset Anchor" for new construction applications.
      - 3) "Water Box for Water Powered Pool Lift"
      - 4) Model 27364 Cover"
    - b. Rechargeable Battery Powered, Fixed Lift: "Swim-Lift Model 57961 Anchored Freedom - ADA Handicap Pool Lift"; Spectrum Aquatics (800-791-8057) including the following accessories:
      - 1) 350 lbs weight capacity
      - 2) One watertight remote control, battery and battery charger, footrest, deck anchor, seat belt.
      - 3) Model 47949 Cover"
    - c. Rechargeable Battery Powered, Fixed Lift: "The Revolution Lift Model F-700RL"; Aqua Creek Products (888-687-3552), including the following accessories:
      - 1) 500 lbs weight capacity
      - 2) Secondary Anchor Kit"
      - 3) "Model F-720RLC Cover"
    - d. Rechargeable Battery Powered, Fixed Lift: "The Scout Lift Model F-8005SC"; Aqua Creek Products (888-687-3552), including the following accessories:
      - 1) 350 lbs weight capacity
      - 2) "Model F-450SC Cover"
    - e. Rechargeable Battery Powered, Fixed Lift: "The Scout Hi-Lift Model F-802SCNA-HLD"; Aqua Creek Products (888-687-3552), including the following accessories:
      - 1) "350 lbs weight capacity

- 2) Model F-450SC Cover"
- f. Approved substitution.
- g. Rechargeable Battery Powered, Portable Lift: "Swim-Lift Model 42618 Portable Freedom - ADA Handicap Pool Lift"; [HYPERLINK TEXT] (800-791-8057) including the following accessories:
  - 1) 300 lbs weight capacity
  - 2) One watertight remote control, battery and battery charger, footrest, deck anchor, seat belt.
  - 3) Model 47949 Cover"
- h. Rechargeable Battery Powered, Portable Lift: "Splash! - Semi Portable Lift System"; S.R. Smith, LLC (800-824-4387), including the following accessories:
  - 1) 400 lbs weight capacity
  - 2) "Model 400-000 Caddy"
  - 3) "Model 940-3000 Total Cover"
- i. Rechargeable Battery Powered, Portable Lift: "The Revolution Lift"; Aqua Creek Products (888-687-3552), including the following accessories:
  - 1) 500 lbs weight capacity
  - 2) "Model FR-714TC Transport Cart"
  - 3) "Model F-710RLA Anchor Kit"
  - 4) "Model F-720RLC Cover"
- j. Approved substitution.
- B. [Portable, ]Hydraulic or battery-powered, self assisted power lift, ADA (2010) compliant, stainless steel frame with a capacity to support minimum 300 pounds with the horizontal arm fully extended. [Must be able to accommodate locations at both the pool.
- C. Provide lifter, anchor assemblies, and all other components required for a complete and operational installation. Provide sleeves in deck at pool .
  - 1. For Hydraulic powered system, furnish and install a stainless steel water box in the pool deck adjacent to the installation site of the lift. A hose spigot shall be plumbed into the box to allow for the connection of a flexible hose.

## EXECUTION

### 3.01 EXAMINATION

- A. Examine areas in which work is to be performed. Report in writing to Owner's Representative all prevailing conditions that will adversely affect satisfactory execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Starting work constitutes acceptance of the existing conditions and this Contractor shall then, at his expense, be responsible for correcting all unsatisfactory and defective work encountered.

### 3.02 PREPARATION

- A. Perform earthwork and dewater excavation in compliance with Section 31 20 00 (02300) - Earthwork. Remove excess earth from site if required and as directed by the Owner's Representative.
- B. Trench for system as specified in Section 31 20 00 (02300) - Earthwork and provide system as specified in Section 33 00 00 (02500) - Utility Services.

### 3.03 INSTALLATION

- A. Formwork and Reinforcement:
  - 1. Install form work to lines and profiles shown. Brace forms for work to prevent movement during concrete placing operations.
    - a. Allow other trades sufficient time for installation of equipment and materials which must be fastened to forms.
    - b. Clean form surfaces prior to concrete placing operations.
  - 2. Place reinforcing steel as shown on drawings. Steel shall be free from dirt' rust' oil, paint and mill scale.

3. Securely wire-tie steel at points where bars cross. Stagger splices and laps.
  4. Install gauging wires to establish thickness of finish work.
  5. After placing pool reinforcing, but before placing concrete, confirm that grounding circuits have been provided by the electrical contractor to steel reinforcement, grab rails, and hand rails, as required by the National Electrical Code, Article 680. No concrete shall be placed until this requirement has been complied with.
- B. Concrete:
1. Placing of "Gunitite" and shotcrete: Conform to the requirements of GCA publication G-84 and as specified herein.
  2. Gunitite:
    - a. Mixing: Mix dry in batch mixing machine for a period of not less than 1 minute.
    - b. Mix and strength: As specified in Part 2.
  3. Shotcrete
    - a. Mixing time: Mixing time for materials delivered by ready-mix trucks to job site, shall not exceed two hours or 250 revolutions of drum, whichever comes first. Additional water may be added at job site only if requested by Contractor. When additional water is added, rotate drum minimum of 30 additional revolutions.
  4. Placing Concrete:
    - a. Place concrete against original undisturbed soil, thoroughly compacted earth.
    - b. Remove all loose, fine aggregate or rebound from surfaces receiving concrete before placing succeeding layers. Whenever possible, first layer shall entirely cover reinforcing steel to secure it in proper position.
    - c. Where new concrete is applied against existing concrete, thoroughly clean the existing surface and drench with water at least twice on the day before placing new concrete. Surfaces upon which concrete will be applied shall be sufficiently damp to prevent excessive absorption of water content in new concrete mix, but not so wet as to overcome suction.
    - d. Concrete deposited on vertical surfaces shall be shot at right angle to surface starting at the bottom and continuing upward. Build up in layers of a thickness that will not slump, allowing sufficient time between placing of layers for initial set to take place.
  5. Finishing:
    - a. When thickness and planes outlined by forms and gauging wires have been reached, rod surfaces to true lines. After rodding, remove gauging wires. Finish all exposed surfaces to straight and true lines.
    - b. Finish: Gun finish as left by nozzle.
  6. Continuously moisture cure for no less than 7 days.
- C. Equipment:
1. Flow meters: Install in straight run of pipe having minimum length of 10 pipe diameters upstream and 4 pipe diameters downstream and in position that can be easily read by operator.
  2. Chemical Feed injection: Locate Injection points downstream from all filter room equipment.
- D. Deck Drain System:
1. Install deck drain system in strict accordance with manufacturer recommendations and written instructions.
  2. Grade subsoil, sloping it toward drain location. Drive 3-1/2" short stakes into ground at 30" o/c - two nailing strips per 10 ft. section. Attach nailing clips and place drain over the stakes. Use couplers to ensure a straight even line. After aligning, nail firmly to stakes.
  3. Insert adapter. Install Clean-out. Place concrete and trowel gradual (min. 1/4"/ft.) slope to drain. After concrete has set, install end plug.
  4. Coordinate removal of protective tape with deck finish coating application.
- E. Piping:
1. Cut all pipe with mechanical cutter without damage to pipe.

2. **Placing and Laying:** Inspect pipe for defects before installation. Clean the interior of pipe thoroughly of foreign matter and keep clean during laying operation. Pipe shall not be laid in water or when trench conditions are unacceptable as determined by the Owner's Representative. Water shall be kept out of the trench until the pipe is installed. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipes or fittings.
3. **Threaded Joints:** After cutting and before threading the pipe shall be reamed and shall have burrs removed. Screw joints shall be made with graphite or inert filter and oil or with an approved graphite compound applied to male threads only. Threads shall be full-cut and not more than 3 threads on the pipe remain exposed. Use Teflon 11 tape on the male threads of all threaded pipe joints. Caulking of threaded joints to stop or prevent leaks will not be permitted. Unions shall be provided where required for disconnection of exposed piping. Unions will be permitted where access is provided.
4. **Solvent welded joints** shall be made in accordance with the manufacturer's printed instructions and the following minimum standards:
  - a. Fittings shall fit easily on the pipe before applying cement. The outer surface area of pipe and inner wall of fitting shall be dry and dean. Thinner is to be applied to the outer surface of the pipe and to the inner surface of the fitting. Cement is to be applied to the outer surface of the pipe, or on the male section of fittings only. When the outside surface area of the pipe is satisfactorily covered with cement allow ten (10) seconds open time to elapse before inserting pipe end into fitting. After full insertion of pipe into fitting, turn fitting about the pipe end approximately 1/8 to 1/4 of a turn. Wipe off excess cement at the joint in a neat cove bead.
  - b. Joints shall remain undisturbed for a minimum of 10 minutes from time of jointing the pipe and fitting. If necessary to apply pressure to a newly made joint, limit to 10% of rated pipe pressure, during the first 24 hours after the joint has been made.
  - c. Full working pressure shall not be applied until the joints have set for a period of 24 hours.
  - d. Make provisions for expansion and contraction by way of swing joints or snaking.
  - e. Protect plastic pipe from exposure to aromatic hydro-carbons, halogenated hydra carbons, and most of esters and ketones that attack the material. Protect all pipe from mechanical damage and long exposure to sunlight during storage.
5. **Install piping** without cross connections or inter-connection between distribution supply for drinking purposes and swimming pool that will permit backflow of water into potable water supply. Pipe openings shall be closed with caps or plugs during installation. Equipment and pool fittings shall be tightly covered and protected against dirt, water and chemical or mechanical injury. At completion of work fittings, materials and equipment shall be thoroughly clean and adjusted for proper operation.
6. **Filter Face Piping:** Arrange to carry out operations of filtering backwashing and filter draining.
7. **Valve identification:** Label all valves.
8. **Testing and Flushing:**
  - a. **Pressure Piping:** After the pipe is laid, the joints completed, and the trench partially backfilled leaving joints exposed for examination, subject new lines to a hydrostatic pressure of not less than 50 pounds per square inch. Joints shall remain watertight under this pressure for a period of two hours.
  - b. **Gravity Lines:** A water test shall be applied to all gravity drain piping system, either in their entirety or in sections. All openings shall be tightly plugged and each system filled with water and tested with at least a 10 foot head of water. Water shall be kept in the system, or in the portion under test's for at least 15 minutes before inspection starts. System shall be tight at all joints.
  - c. **Flushing:** Pipelines leading to the pool shall be thoroughly flushed clean with chlorinated water before the pool is filled and placed in use.

**F. Plaster Finish:**

1. Finish concrete surfaces in pool with a wood float finish to a smooth consistent finish acceptable to Owner Representative.
  2. Fill uneven surfaces and depressions with [manufacturer's recommendations ] [cement plaster brown coat].
  3. Wash all pool surfaces thoroughly with dilute solution of muriatic acid and flush with fresh water to assure a clean surface free of loose materials, dust, and foreign matter.
  4. Plaster installation:
    - a. Apply in accordance with manufacturer's installation instructions.
    - b. Do not apply plaster when rain is imminent or at temperatures below 60°F.
    - c. Apply in two coats using the double-back method to obtain a total thickness of not less than 3/8" or more than 1/2". Use tile as screed.
  5. Trowel to smooth, dense, impervious surface free of stains and uniform white color consistency.
  6. Fill pool as plaster work progresses.
- G. Tile Installation: Where shown on Drawings, use setting materials and grout in accordance with Section 09310 (09 30 13).

### **3.04 FIELD QUALITY CONTROL**

- A. For Guniting Shotcrete Work:
  1. Compressive strength test: Take 1 sample for pool floor construction and 1 sample for wall construction but no less than a minimum test for each 50 cu. yd. of concrete.
  2. Submit copy of test results to Owner's Representative.
- B. Water Treatment
  1. Obtain a chemical analysis of the source/make-up water supply and submit to Owner's Representative. Include the following:
    - a. Total alkalinity/ppm
    - b. Calcium hardness/ppm
    - c. Chlorine/ppm
    - d. pH
    - e. Iron
    - f. Copper
  2. Treat and balance pool water prior to turnover of pool to Owner's Operations Division.
  3. Balance water to establish:
    - a. Total alkalinity: 80-100 ppm
    - b. Calcium hardness: 20~275 ppm
    - c. Total Available CHL (Pool): 1.5 ppm
    - d. Free Available CHL (Pool): 1.5 ppm
    - e. 7.4 - 7.6
    - f. Iron content: 0.0 ppm
    - g. Copper content: 0.0 ppm
    - h. Saturation Index -.3- +.3
  4. Stabilization (outdoor pool) 40 ppm

**END OF SECTION**

**SECTION 14 24 23**  
**HYDRAULIC PASSENGER ELEVATORS**

**GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Furnish and install a complete new [in-ground] [telescopic holeless] hydraulic passenger elevator system including, but not limited to, the elevator cab, elevator entrances, hydraulic cylinder assembly, motor, pump, and controls. The new elevator system shall be furnished and installed in complete accordance with the Specifications and Drawings.
- B. Work Included in Other Sections:
  - 1. General Contractor to provide the following:
    - a. Confirm length, width, and clear overhead dimensions for hoistway, and provide size as required, as approved by Architect and elevator manufacturer.
    - b. Provide all structural supports for guide rails and other mechanisms, as located by elevator manufacturer.
    - c. Sill supports and grouting inside of hoistway for doors.
    - d. Telephone Cable by Division 27 (16).
    - e. Electrical
      - 1) Include auxiliary contact in mainline electrical disconnect switch to signal elevator controller loss of power is shutoff of disconnect switch.
- C. Related Sections:
  - 1. Section 04 20 00 (04200) - Masonry Units
  - 2. Section 05 12 00 (05120) - Structural Steel: Hoisting Beam
  - 3. Section 05 50 00 (05500) - Metal Fabrications: Pit Ladders, Sump Pit Cover
  - 4. Section 09 90 00 (09900) - Painting
  - 5. Division 23 (15) - Heating, Ventilation, and Air Conditioning
    - a. Ventilation and temperature control of elevator equipment room.
    - b. Division 26 (16) - Electrical
      - 1) Electrical service to main disconnect in elevator machine room, electrical power for elevator installation and testing, electrical disconnecting device to elevator equipment prior to activation of sprinkler system, electrical service for machine room, machine room and pit receptacles with ground fault current protection, lighting in machine room and pit, wiring for telephone service to machine room.
      - 2) Telephone Systems; ADAAG-required emergency communications equipment.
    - c. Division 28 (13) - Fire Protection
      - 1) Fire and smoke detectors; fire alarm signal lines to contacts in the machine room.

**1.02 REFERENCES**

- A. Americans with Disabilities Act (ADA) II Public Accommodations
  - 1. "Americans with Disabilities Act Accessibility Guidelines" (ADAAG)
- B. American National Standards Institute (ANSI) Publications:
  - 1. ANSI/ASME 17.1 "Safety Code for Elevators and Escalators"
- C. American Society for Testing and Materials (ASTM):
  - 1. A36 "Standard Specification for Carbon Structural Steel"
  - 2. A167 "Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip"
  - 3. A1008 "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
  - 4. A1011 "Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
    - a. B221 "Aluminum-Alloy Extruded Bars, Rods, Shapes, Tubes"



- b. B209 "Aluminum-Alloy Sheet and Plate"
  - c. A167 "Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip"
  - d. A526 "Steel Sheet, Zinc-Coated, (Galvanized) by the Hot Dip Process, Commercial Quality".
- 5. E84 "Standard Test Method for Surface Burning Characteristics of Building Materials"
- D. National Electrical Manufacturer's Association (NEMA) Standards Publications:
  - 1. LD3 "High Pressure Decorative Laminates"
  - 2. National Fire Protection Association (NFPA) Publications:
  - 3. 80 "Standard for Fire Doors, Fire Windows"
- E. National Institute of Standards and Technology (NIST)
  - 1. PS-1 "Construction and Industrial Plywood"
- F. Federal Specifications (FS) Publications:
  - 1. FS L-P-508 "Plastic Sheet, Laminated, Decorative, and Nondecorative"
- G. American Welding Society (AWS)
  - 1. D1.1 "Structural Welding Code"

### 1.03 DEFINITIONS

- A. Hydraulic Elevators: Elevators in which cars are hoisted either directly or indirectly by action of a hydraulic plunger and cylinder (jack); with other components of the Work, including fluid storage tank, pump, piping, valves, car enclosures, hoistway entrances, operation systems, signal equipment, guide rails, electrical wiring, roping (roped hydraulic applications), buffers, and devices for operations, safety, security, required performance at rated speed and capacity, and for complete elevator installation.
- B. Definitions in ASME A17.1 apply to work of this Section.
- C. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

### 1.04 SYSTEM DESCRIPTION

- A. The work of this Section includes new [holeless] hydraulic passenger elevators to comply with the Americans with Disabilities Act (ADA). Elevator characteristics are as follow:
  - 1. Quantity and Type One [Telescopic] Hydraulic Passenger Elevator
  - 2. Capacity [2500] [3000] [3500] [4000] Pounds
  - 3. Speed 125 Feet per Minute
  - 4. Travel [ ] Floor to [ ] Floor - A distance of [ ]
  - 5. Landings [Three (3)] [Four (4)]
  - 6. Openings Number of Openings: [Three (3)] [Six (6)] [Eight (8)]
  - 7. Front: [Six (6)] [Three (3)] [Four (4)]
  - 8. Rear: [Three (3)] [Four (4)]
  - 9. Operation [Simplex] [Duplex] Selective Collective
  - 10. Clear Car Inside Size:
    - a. [2500] [3000] Pounds: Nominal, Minimum [6'-8"] Wide x [4'-3"] Deep x [8'-0"] [9'-0"] High, and also in accordance with American with Disabilities Act (ADA)
    - b. 3500 Pounds: Nominal, Minimum [6'-8"] Wide x [5'-5"] Deep x [8'-0"] [9'-0"] High, and also in accordance with American with Disabilities Act (ADA)
    - c. 4000 Pounds: Nominal, Minimum [7'-8"] Wide x [5'-5"] Deep x [8'-0"] [9'-0"] High, and also in accordance with American with Disabilities Act (ADA)
    - d. Hoistway Entrances (Size) 3'-6" Wide x 7'-0" High
      - 1) (Type) Side Opening
      - 2) (Fire Rating) 1-1/2 HR
    - e. Power Supply [250] [480] Volts, 3 Phase, 60 Hertz
    - f. Signals Illuminated car and hall buttons, car position indicator with audible signal, car direction sign with dual stroke gong and as specified herein.

- g. Additional Features Complete provisions for the handicapped, infrared screen type detector, emergency light, telephone cabinet, [Voice announcing,] [Electronic start,] [Safety valve,] and as specified herein.

## 1.05 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 (01330) indicating specified items selected for use in project with the following supporting data.
  - 1. Submit Shop Drawings and product data that clearly indicate space requirements, general arrangement of elevator equipment, and material being supplied. Show connections, attachments, reinforcing, anchorage and location of exposed fastenings, and location and amount of loads and reactions to be carried on the building structure.
  - 2. Submit descriptive brochures or detail Drawings of landing buttons, hall fixtures, car position indicators, and car operating panels, car interior, and hoistway doors and frames for review.
  - 3. Samples of exposed finishes for car, hoistway doors and entrances, and operating and signal equipment; 3-inch square samples of sheet materials; and 4-inch lengths of running trim members.
  - 4. Certification that a service office of the manufacturer is located within [100] [50] miles of the Project and that a parts warehouse is located within [100] [50] miles of the Project.
  - 5. Submit repair parts catalogs, instruction manuals, and wiring diagrams specific to this project.
  - 6. Record Documents: Refer to Section 01 78 39 (01785) - Project Record Documents for required closeout documents to be provided at completion of Project.
    - a. Maintenance manuals for each different hydraulic elevator, including operation and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information. Include all diagnostic and repair information available to manufacturer's and Installer's maintenance personnel. Submit for Owner's information at project closeout as specified in Division 01.
- C. Inspection and acceptance certificates and operating permits as required by governing authorities for normal, unrestricted elevator use.

## 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Engage the elevator manufacturer or an experienced Installer approved by the elevator manufacturer who has completed a minimum of 5 years of experience with elevator installations similar in material, design, and extent to that indicated for this Project and a record of successful in-service performance.
- B. Regulatory Requirements:
  - 1. Conform to:
    - a. The American Society of Mechanical Engineers (ASME) Publications:
      - 1) A-17.1 "Safety Code for Elevators, and Escalators"
      - 2) A-17.2 "Guide for Inspection of Elevators, Escalators, and Moving Walks"
      - 3) American National Standards Institute (ANSI) Publications:
        - (a) C1 "National Electric Code"
      - 4) Local and State Codes
      - 5) Americans with Disabilities Act (ADA) II Public Accommodations
        - (a) "Americans with Disabilities Act Accessibility Guidelines" (ADAAG)
      - 6) American Society of Civil Engineers (ASCE) Publications:
        - (a) ASCE 7, "Minimum Design Loads for Buildings and Other Structures" for elevator design requirements for earthquake loads.
    - b. The Elevator Contractor shall obtain and pay for all required inspections and permits and perform tests as called for by regulations of governing authorities.

- C. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
- D. Proprietary Components
  - 1. Processors or other equipment which can only be serviced by the manufacturer are prohibited, unless a non-expiring service/adjustment tool and instructions are provided to Owner at no additional cost.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver items or materials to site after area in which they are to be installed is ready to receive them in their place of final installation.
- B. Store materials in allotted storage area, and in such a manner as to prevent deterioration, damage, or loss of their essential properties.
  - 1. Fully protect movable and operating equipment from weather.
  - 2. Wrap and create factory finished materials in manner to protect their finishes.

#### **1.08 PROJECT CONDITIONS**

- A. Temporary Use of Elevators:
  - 1. The elevator shall not be used for building construction purposes except as directed after acceptance of the complete installation or after signing of Contractor's "Temporary Acceptance" form.
  - 2. If Owner decides to use the elevators prior to completion of project, approval shall begin when elevators are accepted by Owner's Representative. Temporary use will not be considered final acceptance by the Owner or commencement of warranties.
- B. Changes to Drawings and Specification:
  - 1. Review shaft size, machine room size, pit and over-travel dimensions shown on the Drawings and state in a letter with the bid if changes are required to accommodate manufacturer's standard equipment.
  - 2. Failure to furnish such statements will be interpreted to mean that this Contractor agrees to meet all requirements under this Section, and conflicts with the work of other trades will not result in added expense to Owner.

#### **1.09 MAINTENANCE**

- A. Maintenance Service:
  - 1. Provide a separate proposal to Owner to maintain entire elevator installation for 12 months after date of Substantial Completion of Work. Use only competent and trained employees of the manufacturer. Provide 24-hour Emergency Call-Back Service during maintenance period.
  - 2. Include systematic examination, adjustment, and lubrication of elevator equipment, repair, or replace worn electrical and mechanical parts of the elevator equipment using only genuine standard parts produced by manufacturer of equipment concerned.
  - 3. Replace seals, packing, and valves to maintain required factor of safety.
  - 4. Perform work without removing cars during peak traffic periods.
  - 5. Ensure that competent personnel handle maintenance service. Maintain locally an adequate stock of parts for replacement or emergency purposes and have qualified personnel available at such places to ensure the fulfillment of this service without unreasonable loss of time.
  - 6. Indicate amount included in the proposal for this maintenance service. [The Owner may elect to pay in 12 equal monthly amounts over the period of service.]
- B. Maintenance Proposal:
  - 1. Provide separate amount for maintenance of installed elevator work for a period of one year after termination of regular maintenance as required in the preceding Paragraph.
  - 2. Proposal shall include stipulated sum for above stated time period with premiums due quarterly.

## PRODUCTS

### 2.01 MANUFACTURERS

- A. Approved Manufacturers:
  - 1. "MX Series/MCD Cab"; Kone, Inc. (800-956-5663)
  - 2. "Holed Hydraulic"; Otis Elevator Co. (800-441-6847)
  - 3. "Marquis 25"; ThyssenKrupp Elevator (800-824-9666)
  - 4. "Series 330A"; Schindler Elevator Co. (973-397-6500)

### 2.02 MATERIALS

- A. Steel
  - 1. Sheet Steel for Exposed Work: Stretcher-leveled, cold-rolled, commercial-quality carbon steel, complying with ASTM A1008, matte finish.
  - 2. Sheet Steel for Unexposed Work: Hot-rolled, commercial-quality carbon steel, pickled and oiled, complying with ASTM A1011.
  - 3. Structural Steel Shapes and Plates: ASTM A36.
- B. Stainless Steel:
  - 1. Type 300 Series complying with ASTM A167
- C. Aluminum:
  - 1. Extrusions per ASTM B221; sheet and plate per ASTM B209.
- D. Plastic Laminate
  - 1. Materials shall comply with NEMA LD-3:
    - a. Approved Manufacturers:
      - 1) Lamin-Art (800-323-7624)
      - 2) Nevamar Company, LLC (800-638-4380)
      - 3) Pionite Decorative Surfaces, a Panolam Industries International Incorporated Company (800-746-6483)
      - 4) Formica Corporation (800-367-6422)
      - 5) WilsonArt International, Inc. (800-433-3222)
      - 6) Installation adhesives as recommended by manufacturer for use intended.
- E. Fire-Retardant Treated Particleboard Panels:
  - 1. Minimum ½-inch thick backup for plastic laminate veneered panels, provided with suitable anti-warp backing; to meet ASTM E84 Class "A" rating with flame-spread rating of 25 or less.

### 2.03 CAR ENCLOSURE

- A. The elevator cab(s) shall meet the requirements of the ASME A-17.1 Elevator Code, and all Elevator Code Supplements issued to date, including Code restrictions pertaining to flame spread and smoke generation.
- B. The car shall be manufacturer's standard car, with finishes as shown below: :
  - 1. Refer to Interior Finish Index for the following:
    - a. Ceiling
    - b. Front Return Walls
    - c. Rear and Side Walls
    - d. Base
    - e. Entrance Columns
    - f. Transom
    - g. Car Doors
    - h. Car Sills
    - i. Handrails - on rear wall only, Stainless Steel No. 4 Finish, ADA acceptable profile as selected by Owner's Representative, spaced 1-1/2" from the car wall at 32" above car floor.
    - j. Protective pads and hooks - for side and rear walls.

- k. Lighting - The minimum illumination in the car shall be in accordance with the latest edition of ANSI/ASME A-17.1 Elevator Code.
- l. Floor - Carpet to be installed at site, furnished by [Owner].
- m. Signage: Provide engraved sign "Do Not use Elevator in case of Fire - Use Stairs" within cab and beside elevator entrance on each floor. Provide engraved sign "Elevator not to be used by construction personnel" and "Elevator permit on file with manager" in cab.
- n. Provide stainless steel license holder in each elevator car to suit certificate issued. Design holder with non-visible tamper-proof fastenings.
- o. Provide reinforced structure at ceiling in conformance with ASME A-17.1.

#### **2.04 CAR FRAME AND PLATFORM**

- A. The car frame which supports the elevator platform and enclosure shall be made of structural steel members. Platform shall be manufacturer's standard with a suitable sub-floor and a finished floor of carpet by others. Underside of platform shall be properly fireproofed.

#### **2.05 HOISTWAY ENTRANCES AND DOORS**

- A. Hoistway entrances of the hollow metal, horizontal sliding, [side] [center] opening type shall be provided at each of the hoistway openings. Size shall be as indicated in Specification.
- B. Fire Rating: Comply with NFPA 80 and Underwriter's Laboratories, Inc. (UL) label or other as accepted by governing authorities, for rating as indicated on Drawings.
- C. Finish: Refer to Interior Finish Index for the following, unless shown otherwise:
  - 1. Entrance Frame Profile: [Square Jamb]
  - 2. Entrance Frame Material and Finish: [Baked Enamel] [No. 4 Stainless Steel]
  - 3. Door Panels and Sight Guards: [Baked Enamel] [No. 4 Stainless Steel]
  - 4. Entrance Sills: [Extruded Aluminum]
- D. Master Door Operator:
  - 1. A Master Closed Loop, Door Operator shall be provided to open and close the car and hoistway doors simultaneously. Opening speed shall not be less than 2-1/2 feet per second. Closing speed shall not exceed the limitations set by ASME A-17.1. Door movement shall be cushioned or checked at both limits of travel. An electro mechanical interlock shall be provided on each hoistway door to prevent the operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car door to prevent the operation of the elevator unless the car door is closed.
  - 2. The door operator shall be arranged so that, in case of interruption or failure of electric power from any cause, the doors can not be readily opened by hand from within the car, unless the car is within 18 inches of a landing. Emergency devices and keys for opening the doors from the landing shall be provided if allowed by the local codes.
  - 3. The doors shall open automatically when the car is leveling at the respective landings, and shall close after a predetermined time interval or immediately on pressing a car button. A "Door Open" button shall be provided in the car, the momentary pressing of which shall reopen the doors and reset the time interval.
- E. Infrared Door Reopening Device: Black, fully enclosed device. Full screen infrared matrix or multiple beams extending vertically along edge of each leading door panel to a minimum height of 7'-0" above finished floor. Device shall prevent doors from closing and reverse doors at normal opening speed if beams are obstructed while doors are closing, except during nudging operation. If device fails, provide for automatic shutdown of car at floor level with doors open.
  - 1. Acceptable Products:
    - a. "Microlite"; ThyssenKrupp Elevator
    - b. "Lambda"; Otis Elevator Co
    - c. "Microscan E"; T.L. Jones
    - d. "Pana194 Plus" Janus
    - e. "Magic Edge"; Tri-Tronics
    - f. "GateKeeper 2000"; Adams

- F. Door Hangers and Tracks:
1. Hangers and tracks shall be provided at each car and hoistway entrance. Tracks shall be of bar or formed steel with the working surface contoured to match the hanger rollers. The hangers shall be designed for power operation and have provisions for vertical and lateral adjustment. Hangers shall be designed for two point suspension of the door panel.
  2. Hanger rollers shall be polyurethane with pre-lubricated and sealed for life bearings. Car door hangers shall have 3-1/4" diameter hanger rollers. Hoistway door hangers shall be 2-1/2" diameter hanger rollers.
  3. A cable drive shall be used to transmit motion from one door panel to the other.
- G. Hoistway Door Jamb Markings:
1. Floor designation shall be provided on both sides of each hoistway entrance door jamb, visible from within the car and the elevator lobby. Designations shall be Braille and Arabic, 2" high, raised .030" and located 60" above the floor. Include star indication at main egress floor.
  2. At the elevator car that accommodates ambulance stretcher, provide international symbol for emergency medical services (Star of Life) placed inside on both sides of the hoistway door frame. The symbol shall not be less than 3-inches high.

## 2.06 OPERATING EQUIPMENT

- A. Power Unit: A power unit especially designed and manufactured for this service shall be furnished. It shall include a constant displacement rotary screw type pump, motor, V belt drive assembly, oil reservoir, hydraulic control unit, fill strainer, tank strainer in the suction line, oil level gauge and drip pan. The power unit shall be located near the hoistway at the lowest landing.
1. Isolate power unit assembly on vibration absorbing materials to isolate the unit from building structure and guard exposed components with sound absorbing panels.
  2. Power unit shall be designed for 120 upstarts per hour.
  3. Include connections for future addition of an oil cooling unit (air type).
- B. Valves: Control valve including safety check valve, up direction valve with high pressure relief including up leveling and soft stop features, lowering valve including down leveling and manual leveling feature shall be mounted in a compact unit assembly. Control valves shall be solenoid operated and designed to open and close gradually to give smooth control. All valves shall be readily accessible for adjustment.
- C. Automatic Two-Way Leveling: An automatic two-way leveling device shall be provided so that the car will approach landing stops at reduced speed from either direction of travel. The leveling device shall, within its zone, be entirely independent of the operating device and shall automatically stop and maintain the car approximately level with the landing, regardless of change in load.
- D. Plunger: The plunger shall be accurately ground and polished seamless steel. The bottom of the plunger shall be fitted with a heavy steel disc welded in place and provided with a suitable extended edge to provide a positive stop designed to prevent the plunger from leaving the cylinder.
- E. Cylinder: The cylinder shall be machined from steel pipe with a machined flange at the upper end and a heavy steel bulkhead welded in the lower end. The cylinder shall be provided with a suitable steel fitting for connecting to oil line and with an air bleeder.
- F. Cylinder Casings: Protective casings 2 inches (50 mm) larger than cylinders, fabricated from Schedule 40 or 80 PVC pipe complying with ASTM D1785, with bottoms of casings sealed with end caps complying with ASTM D2467 and attached with solvent cement complying with ASTM D2564 shall be provided when cylinders are in ground.
- G. Packing Gland: A steel packing gland with bronze guide bearing, wiper ring and packing especially designed for hydraulic elevator service shall be provided. An oil collector ring and drain hole shall be furnished.

- H. Piping and Oil: Piping shall be provided from power unit to cylinder complete with necessary fittings. Oil of proper grade for this service shall be provided.
- I. A shut off valve (stop cock) shall be provided in the oil line designed to shut off the flow of oil between the cylinder and the power unit. Provide one stop cock in the elevator machine room, and one in the elevator pit. Also, provide a pressure sensitive, mechanically-actuated safety valve conforming to ASME A-17.1 Rule 2410.C.
- J. Hydraulic Muffler: A muffler shall be provided in the oil line near the power unit. The muffler shall be designed to reduce pulsation and noise which may be present in the flow of the hydraulic fluid.
- K. Platen Plate Isolation: The platen plate shall be mounted on suitable sound dampeners designed to isolate the platen plate from the car frame.
- L. Power Unit Isolation: The power unit shall be mounted on vibration sound dampeners designed to isolate the unit from the building structure.
- M. Low Oil Control:
  - 1. A low oil control feature shall be provided designed to automatically cause an up traveling car to descend to the lowest terminal landing if the system does not have a sufficient reservoir of oil.
  - 2. If power operated doors are used, the car and hoistway doors shall automatically open at the lowest terminal landing to permit passengers to egress. The doors shall then automatically close and all control buttons, except the Door Open button in the car operating panel, shall be made ineffective.
  - 3. The oil reservoir should be refilled before the elevator is returned to service.
- N. Guide Rails: Elevator "T" Section guide rails shall be provided and erected plumb and securely fastened to the hoistway framing.
- O. Car Guide Shoes: The top and bottom of the car frame shall be provided with suitable roller guide shoes.
- P. Buffers: Spring buffers shall be provided in the elevator pit.

## **2.07 CONTROLS AND INDICATORS**

- A. Microprocessor Elevator Logic Control: The operation shall be accomplished utilizing microprocessor computer logic control. The elevator control program shall be contained in nonvolatile, programmable, read only memory. Control shall be constructed such that future alterations in elevator operation may readily be made by altering the read only memory. Safety circuits shall be monitored and controlled by the programmable logic control with redundant protection. The microprocessor elevator logic control shall be contained in a Cabinet.
- B. Controller:
  - 1. The controller shall control starting, stopping, and prevent damage to the motor from overload or from excess current. It shall automatically cut off the power supply and bring car to rest in the event of operation of any of the safety devices. The controller shall be enclosed in a cabinet within the Machine Room.
  - 2. Provide solid-state, SCR, closed transition motor starting.
- C. Selective Collective Operation:
  - 1. Pressure upon one or more Car Buttons shall send the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed, provided the hoistway door interlock and car door switch circuits are completed. During this operation, the car shall also answer calls from the landings which are in the prevailing direction of travel. Each landing call shall be cancelled when answered.
  - 2. Pressure upon a Hall Button at a floor above the car location shall cause the car to start Up and answer any Up calls as they are reached by the car irrespective of the sequence in which the buttons had been pressed. The car shall not stop at floors where Down buttons

- only had been pressed. If no further Car or Up Hall calls are registered, the car shall reverse its direction preference for response to Car Calls or Down Hall calls.
3. The car shall start Down to answer calls below the car and shall not stop where Up calls only are registered. When traveling Up, the car shall reverse at the highest call and proceed to answer calls below it. When traveling Down, the car shall reverse at the lowest call and answer calls above it.
  4. Should both an Up and a Down call be registered at an intermediate landing, only the call corresponding to the direction in which the car is traveling shall be cancelled upon the stopping of the car at the landing. Terminal limit switches shall be provided in the hoistway designed to automatically stop the car at or near the closest terminal landing.
- D. Emergency Stop Switch: An emergency stop switch shall be provided in the car, in the pit, and on top of the car as required by ANSI A-17.1, designed to cut off current supply to motor and down direction valves and bring the car to rest independent of the regular operating devices.
- E. Car Operating Panel: A flush-mounted operating panel shall be furnished in the car containing registration push buttons for each floor, alarm button, door open and close push buttons, light switch, independent service switch, emergency personnel operation key switch to accommodate the Owner's interior core keying system.
1. Each car registration button shall illuminate when pressed, signaling that the car has been registered. Each button will remain illuminated until the call has been answered.
  2. Card Reader Lock:
    - a. Rear Elevator Cab Door shall be provided with a card reader compatible with Hotel Door System provided by Section 08 71 00.
      - 1) Card lock system shall be "MT RFID x BLE Lock"; Saflok, a Kaba Group Company (800-523-9605).
    - b. Tactile car control symbols shall be placed adjacent to the emergency stop switch, door open, door close, alarm bell, and all call registration buttons.
    - c. The car operating panel shall be mounted at Code required handicap levels.
- F. Emergency Communication System: Provide hands-free audio Telephone ("Push to Talk") system conforming to ADA recommendations and shall automatically dial [Front Desk] [preprogrammed number as directed by Owner's Representative].
1. Include automatic dialing (minimum rollover for 2 numbers), tracking and recall features with shielded wiring between the car and controller in the machine room (Cable by Div. 26).
  2. Use alarm button or separate button for the "Push to Talk" control.
  3. Button or adjacent light jewel shall illuminate and flash when call is acknowledged. Button shall match floor pushbutton design. Provide uppercase "Push to Call", "Help on the Way" engraved signage Sans Serif or simple Serif type.
  4. Provide Braille, "Telephone" and tactile symbol engraved signage adjacent to button.
  5. System shall be included as part of the car station faceplate and shall include instructions for use, and battery back-up power supply.
- G. Emergency Light: A battery powered emergency light shall be provided in the elevator car.
- H. Car Position Indicator: A digital electric position indicator shall be provided in the elevator car. The position of the car and the hoistway shall be indicated by the illumination of the numeral corresponding to the floor at which the elevator is stopped or passing. An audible signal shall sound to indicate the car is stopping at or passing a floor.
1. Provide similar position indicator at the primary egress floor as directed by the Owner's Representative.
- I. Car Direction Signs: A car direction sign with visual and audible signal shall be provided in the car jamb, located 6'-0" above the car floor. The car direction sign shall be visible from the proximity of the hall push button fixture to indicate to the waiting passenger the direction the car will travel. Two car direction signs shall be provided for each elevator car entrance. Finish to be #4 Stainless Steel.
1. The visual signal lens size shall be at least 2-1/2" in the smallest dimension. The audible signal shall sound once for the up direction and twice for the down direction.



- J. Hall Push Buttons: A hall push button station shall be provided for each elevator landing, containing a single push button at the terminal landings and two push buttons at the intermediate landings. Each push button shall illuminate when a call is registered, and shall extinguish when the call is answered. The hall push button fixture shall be mounted at the handicapped required height. Finish to be #4 Stainless Steel.
- K. Hall Lantern: Provide at each entrance to indicate travel direction of arriving elevator. Located above the hall push buttons, 6'-0" above the car floor. Illuminate indicators with shielded LED lights. Illuminate up or down lights and sound tone, twice for down direction travel, prior to car arrival at floor. Sound level to be adjustable from 20 - 80 dB measured at 5'-0" in front of corridor pushbutton and 3'-0" off floor. Illuminate light until the elevator doors start to close. Provide advanced hall lantern notification to comply with ADA corridor call notification time. Minimum 2-1/2" in the smallest dimension, arrow lenses with faceplates. Combine lantern with First Floor/Lobby position indicator. Finish to be #4 Stainless Steel.
- L. Fire Emergency Service: Provide in conformance with ASME A-17.1
- M. Battery Standby Power Transfer (Emergency Return Unit): Upon loss of normal power, provide controls to automatically lower the car(s) nonstop to the lowest landing. Upon arrival at the lowest landing, the elevator doors shall open automatically and remain open until regular door time has expired. The elevator shall then become deactivated. The standby power source shall be provided via 12-volt D.C. battery units installed in machine room, including solid-state charger and testing means mounted in a common metal container. Battery to be rechargeable lead acid or nickel cadmium with a 10-year life expectancy.
  - 1. Upon restoration of normal power, the elevator shall automatically resume normal operation.

## **EXECUTION**

### **3.01 INSPECTION**

- A. Examine work of other Sections on which the work of this Section depends. Report defects to Owner's representative in writing which may affect work of this Section or equipment operation.
  - 1. Review shaft size, machine room size, pit and over-travel dimensions shown on the Drawings and report in writing if changes are required to accommodate manufacturer's standard equipment.
  - 2. Failure to furnish such statements will be interpreted to mean that this Contractor agrees to meet all requirements under this Section, and conflicts with the work of other trades will not result in added expense to Owner.
- B. Ensure that shafts and openings for moving equipment are plumb, level, and in-line and that pit is to proper depth with ladder.
- C. Ensure that Machine Room is properly illuminated, heated, and ventilated and equipment foundations correctly located, complete with floor and access door.

### **3.02 PREPARATION**

- A. Before fabrication of controls, take necessary job site measurements and verify where work is governed by other Sections. Check measurement of space for equipment and means of access for installation and operation. Obtain dimensions from site for preparation of Shop Drawings.
- B. Ensure the following preparatory work, provided under other Sections has been properly completed to receive the elevator work:
  - 1. Supply of electric feeder wires to the terminals of the elevator control panel, including fused main line switch or circuit breaker. Provision of hoistway outlets for car light, and for light in pit and outlets in machine room for light. Furnishing of electric power for testing and adjusting elevator equipment.
  - 2. Provision of hoistway outlet for telephone.
  - 3. Supply of power for emergency cab lighting and ventilation from power panel specified in Division 26 and fed by the building emergency circuits.
  - 4. Machine room enclosed and protected from moisture, with lockable door.

- C. Supply in ample time for installation, inserts, anchors, pipe sleeves, bearing plates, brackets, supports and bracing including setting templates and diagrams for placement.

### **3.03 INSTALLATION**

- A. Perform work with competent mechanics skilled in this work and under the direct control and supervision of the elevator manufacturer's experienced foreman.
- B. Set hoistway entrances in alignment with car openings and true with plumb sill lines.
- C. Install machinery, guides, controls, car, and equipment and accessories in accordance with manufacturer's instructions, applicable codes, and standards to provide a quiet, smoothly operating installation, free from sideway, oscillation, or vibration.
- D. Mount machine immediately adjacent to hoistway on concrete foundation. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.
- E. Install and hook-up piping between machine and cylinder.

### **3.04 FIELD QUALITY CONTROL**

- A. Obtain and pay for inspections and permits and make such tests as are required by regulations of authorities. Make tests in presence of Owner's Representative.
- B. Final inspection shall be after elevator installation, hoisting enclosure, and machine room are complete.
- C. Inspect installation in accordance with ASME A-17.2.
- D. Deliver test certificates and permits to Owner.

### **3.05 ADJUSTING AND CLEANING**

- A. Make necessary adjustments of equipment to ensure elevator operates smoothly and accurately.
- B. Prior to final acceptance, remove protection from exposed surfaces and clean and polish surfaces with due regard to type of material.
- C. At completion of work of this Section, except for special tools and diagnostic equipment, remove tools, equipment and surplus materials from site.

### **3.06 TRAINING**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.
  - 1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining system.

**END OF SECTION**

**SECTION 21 0500  
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.
- B. Incoming fire service backflow preventer.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 09 9123 - Interior Painting: Preparation and painting of interior fire protection piping systems.
- C. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.
- E. Section 21 1200 - Fire-Suppression Standpipes: Standpipe design.
- F. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

**1.03 REFERENCE STANDARDS**

- A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- B. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.
- F. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.
- G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings 2018.
- H. ASME B16.11 - Forged Fittings, Socket-welding and Threaded 2016 (Errata 2017).
- I. ASME B16.25 - Buttwelding Ends 2017.
- J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- L. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2021.
- M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- N. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- O. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 2017.
- P. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2019.
- Q. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) 2019.
- R. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2014.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).
- T. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.
- U. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2012.

- V. AWWA C606 - Grooved and Shouldered Joints 2015.
- W. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- X. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2019.
- Y. UL (DIR) - Online Certifications Directory Current Edition.

#### **1.04 PERFORMANCE REQUIREMENTS**

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13 - Standard for the Installation of Sprinkler Systems
  - 2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
  - 3. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection
- B. Delegated Design: Engage a qualified Fire Protection professional engineer, as defined in Section 014000 "Quality Requirements," to design project sprinkler systems. Base calculations on results of fire-hydrant flow test. Flow test shall be performed within one year of construction start.
- C. Hydraulic Design Criteria: Sprinkler system design shall be approved by authorities having jurisdiction, Owner's Insurance Underwriter (where applicable) and shall be designed according to the following:
  - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers, or 10 psi, whichever is greater.
  - 2. Sprinkler Occupancy Hazard Classifications: Refer to Drawings.
  - 3. Minimum Density for Automatic-Sprinkler Piping Design: Refer to Drawings.
  - 4. Maximum Protection Area per Sprinkler: According to the latest NFPA 13 standard, UL listing and as specified on Drawings.
  - 5. Total Combined Hose-Stream Demand Requirement: According to latest NFPA 13 standard unless otherwise indicated on drawings.
  - 6. Water velocity in the piping system shall not exceed the following:
    - a. Underground mains: 16 ft/sec.
    - b. Aboveground mains: 32 ft/sec.
    - c. Sprinkler branch lines: 20 ft/sec.
  - 7. Water supply noted on the drawings. If not, Contractor shall make flow test to ascertain water flow.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Delegated-Design Submittal: For all sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Shop Drawings and Hydraulic Calculations:
    - a. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.
    - b. Indicate installation, layout, weights, mounting and support details, and piping connections.
    - c. Layout and name (or number) of each room repeated as shown on the Architect's/Engineer's plans.
    - d. Reflected ceiling plan for each area showing location of partition walls, ceiling grid lines, ceiling light fixtures; proposed location of all fire sprinker heads; and size and location of all piping. Shop drawings shall clearly identify any areas proposed to be protected with "dry type" systems and "anti-freeze type" systems and shall identify sprinkler heads rated for discharge at temperatures other than 165 degrees F.
    - e. Shop drawings shall be submitted to the Architect/Engineer, AHJ and Owner's Insurance Underwriter (where applicable) for review and approval.
- C. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department or pump test header connection.
  3. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Victaulic style number.
- D. Shop Drawings, Product Data and Hydraulic calculations shall be reviewed as one package; review of submittals shall not start until Engineer has all product data, hydraulic calculations and shop drawings.

#### **1.06 QUALITY ASSURANCE**

- A. Requirements of Regulatory Agencies:
1. Provide fire protection work per the mandatory code requirements, standards of NFPA, and the requirements of the Owner's Insurance Underwriter, where applicable, except where more stringent requirements are indicated, as modified and supplemented by the Contract Documents. The NFPA requirements include the appendices and supplements.
  2. The provisions and recommendations of the NFPA constitute mandatory minimum requirements for work specified herein. No payment will be made by the Owner for extra charges for work added in order to comply with NFPA Standards and Owner's Insurance Underwriter requirements, where applicable.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified Fire Protection engineer.
- D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.
- E. Comply with UL (DIR) requirements.
- F. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- G. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- H. Pipe: Each length of pipe shall be legibly identified at mill by paint, stenciling or raised symbols identifying manufacturer and class type or schedule of pipe. Copper pipe shall be identified at 3 foot intervals.
- I. Fittings: To be identified by manufacturer by permanently attached tags, imprints or other approved means indicating class of wall thickened and material.

#### **1.07 DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER**

- A. Should the Division 23 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design on the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

#### **1.08 FIELD CONDITIONS - RENOVATION PROJECTS**

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
1. Notify Architect & Construction Manager no fewer than five days in advance of proposed interruption of sprinkler service.

2. Do not proceed with interruption of sprinkler service without Architect's and Construction Manager's written permission.

## **1.09 DELIVERY, STORAGE AND HANDLING**

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

## **PART 2 PRODUCTS**

### **2.01 FIRE PROTECTION SYSTEMS**

- A. Sprinkler Systems: Comply with NFPA 13.
- B. Standpipe and Hose Systems: Comply with NFPA 14.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

### **2.02 BURIED PIPING**

- A. Steel Pipe: ASTM A53/A53M Schedule 40 or ASTM A135/A135M Schedule 10, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
  1. Steel Fittings: ASME B16.9, wrought steel, butt welded, ASME B16.25, butt weld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
  2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
  3. Joints: Welded in accordance with AWS D1.1/D1.1M.
  4. Casing: Closed glass cell insulation.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
  1. Fittings: AWWA C110/A21.10, standard thickness.
  2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket.
  3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

### **2.03 ABOVE GROUND PIPING**

- A. Steel Pipe: ASTM A53 Schedule 40 or ASTM A135/A135M Schedule 10, black.
  1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
  2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
  3. Ductile iron Fittings: ASTM A536, Grade 65-45-12. In applicable sizes, fittings shall be short pattern, with flow equal to standard pattern fittings.
    - a. Basis of Design: Victaulic FireLock.
  4. Mechanical Grooved Couplings: Two ductile iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, ASTM A449 compliant steel bolts, nuts; galvanized for galvanized pipe.
    - a. Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with NFPA-13, fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping at specific torque ratings are not permitted.
      - 1) Installation-Ready for complete installation without field disassembly.
      - 2) Basis of Design: Victaulic Style 009N and 107N.
    - b. Flexible Type: For use in locations where vibration attenuation and stress relief are required.
      - 1) Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.
    - c. Installation-Ready gaskets are center-leg, with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.
  5. Installation-Ready fittings for Schedule 40 & 10 grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½ (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready ends, orange enamel coated, red enamel coated or galvanized. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM

A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).

6. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.
- B. CPVC Pipe (for Residential NFPA 13R applications only): ASTM F442/F442M, SDR 13.5.
  1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
  2. Joints: Solvent welded, using ASTM F493 cement.

## **2.04 PIPE SLEEVES**

- A. Vertical Piping:
  1. Sleeve Length: 1 inch above finished floor.
  2. Provide sealant for watertight joint.
- B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
  1. Zinc coated or cast iron pipe.
  2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
  1. Brass pipe.
  2. Connect sleeve with floor plate.
- E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
  1. Galvanized steel pipe or black iron pipe with asphalt coating.
  2. Connect sleeve with floor plate except in mechanical rooms.
- F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
  1. Galvanized steel pipe or black iron pipe with asphalt coating.
  2. Connect sleeve with floor plate except in mechanical rooms.
- G. Clearances:
  1. Provide allowance for insulated piping.
  2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
  3. Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

## **2.05 MANUFACTURED SLEEVE-SEAL SYSTEMS**

- A. Modular/Mechanical Seal:
  1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
  2. Provide watertight seal between pipe and wall/casing opening.
  3. Elastomer element size and material in accordance with manufacturer's recommendations.

## **2.06 ESCUTCHEONS**

- A. Material:
  1. Metals and Finish: Comply with ASME A112.18.1.
- B. Construction:
  1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
  2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

## **2.07 PIPE HANGERS AND SUPPORTS**

- A. Supporting Elements: provide UL/FM components per NFPA 13, ANSI B 31.1 and MSS SP-58 except that "C" clamps or any modification thereof are unacceptable.

1. "C" clamps: With set screw, locknut and restraining strap are acceptable for piping up to 2-1/2".
- B. Furnish necessary piping and equipment supporting elements including; building structure attachments; supplementary steel; hanger rods, stanchions and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides.
- C. Center Loading Beam Clamps: For attachments to building structure as approved except piping supported from top of steel.

## **2.08 MECHANICAL COUPLINGS**

- A. Manufacturers:
  1. Tyco Fire Protection Products: [www.tyco-fire.com/#sle](http://www.tyco-fire.com/#sle).
  2. Victaulic Company: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
  3. Anvil/Gruvlok: [www.anvilintl.com](http://www.anvilintl.com)
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Rigid Mechanical Couplings for Grooved Joints:
  1. Dimensions and Testing: Comply with AWWA C606.
  2. Minimum Working Pressure: 300 psig.
  3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
  4. Gasket Material: EPDM-HP suitable for operating temperature range from minus 30 degrees F to 250 degrees F.
  5. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.
- C. Only use grooved coupling as permitted by NFPA 13 and NFPA 14.

## **2.09 INCOMING FIRE SERVICE BACKFLOW PREVENTER**

- A. A backflow preventer assembly shall be installed on fire protection systems when connected to a drinking water supply. Degree of hazard present and type of incoming service backflow preventer shall be coordinated with the Authority Having Jurisdiction.
- B. Double Check Detector Assembly
  1. ASSE 1048, UL 1469, AWWA C510-92: The main valve body shall be manufactured from 300 Series stainless-steel to provide corrosion resistance, 100% lead free\* through the waterway. The double check detector assembly consists of two independently operating, spring loaded check valves, two UL, FM, OSY resilient seated gate valves, and bypass assembly. The bypass assembly consists of a meter, a double check including shutoff valves and required test cocks. Each cam-check shall be internally loaded and provide a positive drip tight closure against reverse flow. Cam-check includes a stainless-steel cam arm and spring, rubber faced disc and a replaceable seat. There shall be no brass or bronze parts used within the cam-check valve assembly. The check valve seats shall be of molded thermoplastic construction. The use of seat screws as a retention method is prohibited. All internal parts shall be accessible through a single cover on the valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling. The bypass line shall be hydraulically sized to accurately measure low flow. The bypass line shall consist of a meter, a small diameter double check assembly with test cocks and isolation valves. The bypass line double check valve shall have two independently operating modular poppet check valves, and top mounted test cocks.
  2. May be installed horizontal or vertical "flow up" position.
  3. Basis of Design: Ames Series 3000SS

## **PART 3 EXECUTION**

### **3.01 FIRE SUPPRESSION PIPING APPLICATIONS**

- A. CPVC pipe, Schedule 40 or Schedule 80 CPVC fittings, and solvent-cemented joints may be used for residential occupancies ONLY.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
  1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  2. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.



- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and larger, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 2. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
  - 3. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 4. Schedule 10, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
  - 5. Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.
- D. High-pressure, wet-pipe sprinkler system, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

### **3.02 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

### **3.03 INSTALLATION**

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
- C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- D. Install piping to conserve building space, to not interfere with use of space and other work.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
  - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 2. Place hangers within 12 inches of each horizontal elbow.
  - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 6. Provide copper plated hangers and supports for copper piping.
- H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Structural Considerations:
  - 1. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- L. Manufactured Sleeve-Seal Systems:
  - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
  - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
  - 3. Locate piping in center of sleeve or penetration.
  - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.

5. Tighten bolting for a water-tight seal.
  6. Install in accordance with manufacturer's recommendations.
- M. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
  2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
  3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- O. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.
- P. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space. If conflicts arise making this impossible, obtain instructions from Architect before proceeding with work.
- Q. Where there is evidence that parts of fire protection work will interfere with other work, assist in working out space conditions and/or structure, make necessary adjustments to accommodate work.
- R. Fire protection work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.
- S. Accessibility:
1. Install fire protection work to permit removal (without damage to other parts) of coils, heat exchangers, pumps, fan shafts and wheels, belt guards, sheaves and drives and other parts requiring periodic replacement or maintenance.
  2. Arrange pipes and equipment to permit ready access to valves, cocks, traps, starters, motors, dampers, control components and to clear openings of swinging and overhead doors and of access panels.
- T. When necessary to install "U"-shaped dip in a pipe due to a conflict with duct work or other building components, Contractor shall install a  $\frac{3}{4}$ " diameter hose nipple and cap pointing down at lowest point in pipe dip. Contractor shall try to arrange piping layout to avoid such dips; no such dip shall be installed without prior approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.
- U. When necessary to install inverted "U" in branch piping to rise above an obstruction, Contractor shall install an upright  $\frac{3}{4}$ " diameter air vent nipple and cap at high point of inverted "U". Contractor shall try to arrange piping layout to avoid such high points; no such installation shall be made without approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.
- V. Contractor shall provide Owner with at least 24 hours prior notice before commencing sprinkler installations. Owner shall be responsible for deactivating building alarm system and notifying local fire department or other agencies. Under no circumstances shall Contractor attempt to deactivate building alarm system or circumvent any valve tamper switch. Contractor shall perform all work during normal business hours. By the end of each working day, Contractor shall cap all pipe ends.
- W. Pressure test completed work in progress, repair any leaks and otherwise make the sprinkler system water tight so that fire alarm and sprinkler protection system can be reactivated by Owner during non-business hours.

### **3.04 SOUND CONTROL**

- A. Penetrations shall be maintained airtight to prevent sound transfer.
- B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

### **3.05 CLEANING**

- A. Flush entire piping system of foreign matter in accordance with NFPA 13.
- B. Upon completion of work, clean all parts of the installation.
- C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

### **3.06 TESTING AND ACCEPTANCE**

- A. After completing branch system, Contractor shall test fire sprinkler piping hydrostatically for a period of two hours at not less than 200 psi or at 50 psi in excess of the maximum operating static pressure when the maximum static pressure exceeds 150 psi. Contractor shall check system for leakage of joints and measure hydrostatic pressure at low point of each system or zone being tested.
- B. The Contractor shall repair or replace piping and fittings as required to eliminate leakage (in accordance with NFPA standards for "little or no leakage") and retest as specified to demonstrate compliance.
- C. Upon satisfactory completion and testing of branch piping system, Contractor shall provide Owner with a letter certifying that branch piping system has been completed in accordance with NFPA 13 and is operational, complete and has no defects.
- D. Test shall be witnessed by Architect/Owner and any authorities having jurisdiction who may so require.

**END OF SECTION**

**SECTION 21 0523**  
**GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Bronze butterfly valves with indicators.
- B. Iron butterfly valves with indicators.
- C. Check valves.
- D. Bronze OS&Y gate valves.
- E. Iron OS&Y gate valves.
- F. Trim and drain valves.

**1.02 RELATED REQUIREMENTS**

- A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.
- B. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.
- C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.
- D. Section 28 4600 - Fire Detection and Alarm.

**1.03 ABBREVIATIONS AND ACRONYMS**

- A. EPDM: Ethylene-propylene diene monomer.
- B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- C. NRS: Non-rising stem.
- D. OS&Y: Outside screw and yoke.
- E. PTFE: Polytetrafluoroethylene.
- F. SBR: Styrene-butadiene rubber.

**1.04 REFERENCE STANDARDS**

- A. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory Current Edition.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
  - 1. Obtain valves for each valve type from single manufacturer.
  - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Where listed products are specified, provide products listed, classified, and labeled by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- D. Grooved end valves shall be of the same manufacturer as the adjoining couplings.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

- A. Comply with NFPA 13 for valves.

- B. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
  - 2. Handwheel: For other than quarter-turn trim and drain valves.
  - 3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

## **2.02 BRONZE BUTTERFLY VALVES WITH INDICATORS**

- A. Minimum Pressure Rating: 175 psig.
- B. Body Material: Bronze.
- C. Seat: EPDM.
- D. Stem: Bronze or stainless steel.
- E. Disc: Bronze with EPDM coating.
- F. Actuator: Worm gear or traveling nut.
- G. Supervisory Switch: Internal or external.

## **2.03 IRON BUTTERFLY VALVES WITH INDICATORS**

- A. Minimum Pressure Rating: 300 psig.
- B. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
- C. Seat: Pressure-responsive EPDM.
- D. Stem: Stainless steel, offset from the disc centerline to provide complete 360-degree circumferential seating.
- E. Disc: Ductile iron, electroless-nickel plated.
- F. Actuator: Weatherproof actuator housing with worm gear or traveling nut.
- G. Supervisory Switch: Internal or external.
- H. Body Design: Grooved-end connections.
  - 1. Basis of Design: Victaulic Series 705.

## **2.04 CHECK VALVES**

- A. Minimum Pressure Rating: 250 psig.
- B. Type: Center guided or spring-assisted swing check valve for vertical or horizontal installation.
- C. Body Material: Cast iron, ductile iron.
- D. Center guided check with elastomeric seal or elastomer coated disc.
- E. Hinge Spring: Stainless steel.
- F. End Connections: Flanged, grooved, or threaded.
  - 1. Basis of Design: Victaulic Series 717.

## **2.05 BRONZE OS&Y GATE VALVES**

- A. Minimum Pressure Rating: 175 psig.
- B. Body and Bonnet Material: Bronze or brass.
- C. Wedge: One-piece bronze or brass.
- D. Wedge Seat: Bronze.
- E. Stem: Bronze or brass.
- F. Packing: Non-asbestos PTFE.
- G. Supervisory Switch: External.
- H. End Connections: Threaded.

## **2.06 IRON OS&Y GATE VALVES**

- A. Minimum Pressure Rating: 250 psig.

- B. Body and Bonnet Material: Cast or ductile iron.
- C. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
- D. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
- E. Stem: Brass or bronze.
- F. Packing: Non-asbestos PTFE or EPDM.
- G. Supervisory Switch: External.
- H. End Connections: Flanged or grooved ends.
  - 1. Basis of Design: Victaulic Series 771.

## **2.07 TRIM AND DRAIN VALVES**

- A. Ball Valves:
  - 1. Description:
    - a. Pressure Rating: 175 psig.
    - b. Body Design: Two piece.
    - c. Body Material: Forged brass or bronze.
    - d. Port Size: Full or standard.
    - e. Seat: PTFE.
    - f. Stem: Bronze or stainless steel.
    - g. Ball: Chrome-plated brass.
    - h. Actuator: Hand-lever.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Confirm valve interior to be free of foreign matter and corrosion.
- B. Remove packing materials.
- C. Examine guides and seats by operating valves from the fully open position to the fully closed position.
- D. Examine valve threads and mating pipe for form and cleanliness.
- E. Examine grooved ends for form and cleanliness. Ends shall be clean and free from indentations and projections, and roll marks in the area from valve end to (and including) the groove.

### **3.02 INSTALLATION**

- A. Comply with specific valve installation requirements and application in all applicable Division 21 Sections.
- B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
  - 1. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Provide drain valves plugged with hose adapter with cap and chain at main shut off valves, low points of piping and any apparatus. Drain valve to be size ¾" minimum.
- D. Provide OS&Y gate valves for shut-off or isolating services. Valves to have OS&Y tamper monitor switch as required by NFPA or where indicated on drawings.
- E. Where approved, butterfly valves may be used instead of gate valves. Valves to have tamper monitor switch as required by NFPA or where indicated on drawings.
- F. In addition to tamper monitor switches (only if required by Owner or local authorities), provide each control valve with approved padlock and chain. All padlocks shall be keyed alike
- G. Provide hand wheels for gate valves.
- H. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.
- I. Valves in horizontal piping installed with stem at or above the pipe center.
- J. Position valves to allow full stem movement.

- K. Install valve tags. Comply with Section 21 0553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

**END OF SECTION**

**SECTION 21 0553**  
**IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nameplates.

**1.02 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.

**PART 2 PRODUCTS**

**2.01 IDENTIFICATION APPLICATIONS**

- A. Control Panels: Nameplates.
- B. Pumps: Nameplates.
- C. Valves: Nameplates.

**2.02 NAMEPLATES**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 2. Kolbi Pipe Marker Company: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 3. Seton Identification Products, a Tricor Direct Company: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Laminated three-layer plastic with engraved letters.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

**3.02 INSTALLATION**

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

**END OF SECTION**



**SECTION 21 1200  
FIRE-SUPPRESSION STANDPIPES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Valves.
- B. Fire department connections.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.
- B. Section 21 0500 - Common Work Results for Fire Suppression: Fire protection piping.
- C. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

**1.03 REFERENCE STANDARDS**

- A. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2019.
- B. NFPA 1963 - Standard for Fire Hose Connections 2019.
- C. UL 405 - Fire Department Connection Devices Current Edition; Including All Revisions.
- D. UL (DIR) - Online Certifications Directory Current Edition.

**1.04 SUBMITTALS**

- A. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.

**1.05 QUALITY ASSURANCE**

- A. Perform Work in accordance with NFPA 14. Maintain one copy on site.

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 VALVES**

- A. Specialty Valves:
  - 1. Hose Connection Valve:
    - a. Angle type; brass finish; 2-1/2 NPS, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish.
- B. Hose Connection Valve Cabinets:
  - 1. Style: Recessed mounted.
  - 2. Tub: 16 gage, 0.0598 inch thick steel, prepared for pipe and accessory rough-in.
  - 3. Door: 12 gage, 0.1046 inch thick steel, flush, glazed with 1/4 inch (6.35 mm) thick wired glass full panel; hinged, positive latch device.
  - 4. Finish: Prime coated.

**2.02 FIRE DEPARTMENT CONNECTIONS**

- A. Type: Free standing made of corrosion resistant metal complying with UL 405.
  - 1. Manufacturers:
    - a. Elkhart Brass Manufacturing Company, Inc; [\_\_\_\_]: [www.elkhartbrass.com/#sle](http://www.elkhartbrass.com/#sle).
    - b. Fire End & Croker Corporation; [\_\_\_\_]: [www.croker.com/#sle](http://www.croker.com/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
  - 3. Rated Working Pressure: 175 psi.
  - 4. Finish: Chrome.
  - 5. Sleeve: Brass, 18 inches height.

6. Signage: Raised or engraved lettering 1 inch minimum indicating system type.
- B. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for localized system drainage to prevent freezing.
  1. Basis of Design: Victaulic #10-DR.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 14.
- C. Connect standpipe system to water source ahead of domestic water connection.
- D. Flush entire system of foreign matter.

#### **3.02 FIELD QUALITY CONTROL**

- A. Test entire system in accordance with NFPA 14.
- B. Test shall be witnessed by Fire Marshal.

**END OF SECTION**

**SECTION 21 1300  
FIRE-SUPPRESSION SPRINKLER SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wet-pipe sprinkler system.
- B. Dry-pipe sprinkler system.
- C. System design, installation, and certification.

**1.02 RELATED REQUIREMENTS**

- A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.
- B. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.
- D. Section 21 1200 - Fire-Suppression Standpipes: Fire Department Connections.

**1.03 REFERENCE STANDARDS**

- A. ITS (DIR) - Directory of Listed Products current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
  - 3. Sprinkler Wrenches: For each sprinkler type.
- E. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

**1.05 QUALITY ASSURANCE**

- A. Comply with UL (DIR) requirements.
- B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
  - 1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Sprinklers, Valves, and Equipment:
  - 1. Victaulic Company: [www.victaulic.com](http://www.victaulic.com)
  - 2. Viking Corporation: [www.vikinggroupinc.com/#sle](http://www.vikinggroupinc.com/#sle).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for building areas noted.
- B. Occupancy: Refer to Schedule on Drawings.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Interface system with building fire and smoke alarm system.
- E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

## 2.03 SPRINKLERS

- A. Sprinklers shall be glass bulb type, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.
  - 1. Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body.
- B. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
    - a. Basis of Design: Victaulic Model V38.
- C. Exposed Area Type: Pendant type with guard.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
    - a. Basis of Design: Victaulic Model V27.
- D. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- E. Flexible Drop System: Stainless steel, multiple use, open gate type.
  - 1. Application: Use to properly locate sprinkler heads.
  - 2. Include all supports and bracing.
  - 3. Provide braided type tube as required for the application.
  - 4. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.
  - 5. The drop shall include a UL approved Series AH1 with 3" bend radius; AH2 or AH2-CC braided hose with a bend radius to 2" to allow for proper installation in confined spaces.
  - 6. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place.
  - 7. Manufacturers:
    - a. Victaulic Company; Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System [with captured coupling Style 108].
    - b. Substitutions: See Section 01 6000 - Product Requirements.
  - 8. In lieu of rigid connections to dry sprinkler heads, a Victaulic VicFlex™ dry sprinkler, Model VS1, may be used. The sprinkler shall provide a vertical or horizontal flexible connection with a bend radius to 2", and allow for up to 4 bends
  - 9. In lieu of rigid pipe offsets or return bends for sprinkler drops in wet, dry, and preaction systems in cold storage applications, the Victaulic VicFlex™ V33, V36, or V40 Dry Sprinkler with Integral AB6 Assembly may be used.
  - 10. In lieu of threaded steel piping systems, the Victaulic FireLock IGS System with "Installation-Ready™ fittings and couplings may be used for NPS 1 (DN 25) Schedule 10 and Schedule 40 carbon steel pipe in fire protection applications. System rated for a working pressure to 365 psi (2517 kPa).

- a. Groove: IGS "Innovative Groove System" groove with shortened "A" dimension and tapered groove backside for ease of installation.
- b. Grooving Tool: Victaulic RG2100, with IGS Confirmation Gauge.
- c. Victaulic V9 sprinkler heads may be used in direct substitution where applicable.

## 2.04 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
  - 1. Activate electric alarm.
  - 2. Test and drain valve.
  - 3. Replaceable internal components without removing valve from installed position.
  - 4. Manufacturers:
    - a. Victaulic Company; Series 751 with Series 760 motor alarm: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Riser Manifold Assemblies
  - 1. Riser Manifold: integral vane type flow switch and test drain assembly with pressure gauge, grooved connections, 250 psi maximum working pressure; all components to be UL listed.
  - 2. Universal Manifold Check Assembly: Ductile iron construction, incorporating a control valve, check valve, flow switch, adjustable relief valve, and system gauges in one compact body/footprint. The assembly should include the following additional capabilities and features:
    - a. Activate electric alarm.
    - b. Test and drain assembly with a universal test orifice and adjustable relief valve with a range of 175 to 310 psi.
    - c. Replaceable internal components without removing valve from installed position.
    - d. Rated for use at the maximum service pressure of 300 psi.
    - e. UL Listed and FM Approved.
    - f. Manufacturers:
      - 1) Victaulic Company; Model Globe UMC: <https://globesprinkler.com/product-detail/umc-floor-control-shotgun-riser-assembly>.
      - 2) Substitutions: See Section 01 6000 - Product Requirements.
- C. Test Connections:
  - 1. Inspector's Test Connection:
    - a. Acceptable Manufacturers
      - 1) AFG Manufacturing
      - 2) Elkhart Brass
      - 3) Guardian Fire Equipment Inc.
      - 4) Potter-Roemer
    - b. UL/FM Cast brass body with spring loaded position indicator with positive shut-off. In-line flow with self-draining, clearable sight glass. Tamper-proof orifice permanently installed. Model 1000 Test and Drain manufactured by AFG Manufacturing Inc.
- D. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- E. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Locate outside alarm gong on building wall as indicated.
- D. Place pipe runs to minimize obstruction to other work.
- E. Place piping in concealed spaces above finished ceilings.
- F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

- G. Do not install sprinklers that have been dropped, damaged, show a visible loss of fluid, or a cracked bulb.
- H. The sprinkler bulb protector shall be removable by hand, without tools or devices that may damage the bulb.
- I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- J. Flush entire piping system of foreign matter.
- K. Hydrostatically test entire system.
- L. Require test be witnessed by Fire Marshal.

### **3.02 INTERFACE WITH OTHER PRODUCTS**

- A. Ensure required devices are installed and connected as required to fire alarm system.

**END OF SECTION**

## **SECTION 21 3000 FIRE PUMPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Fire pump, electric motor drive, controller, and accessories.
- B. Electric jockey pump.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 21 0500 - Common Work Results for Fire Suppression: Fire protection piping.
- B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### **1.03 REFERENCE STANDARDS**

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection 2018.
- D. UL (DIR) - Online Certifications Directory Current Edition.
- E. UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service Current Edition, Including All Revisions.
- F. UL 778 - Standard for Motor-Operated Water Pumps Current Edition, Including All Revisions.
- G. UL 1478 - Fire Pump Relief Valves Current Edition, Including All Revisions.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.
- C. Certificates: Certify that fire pumps meet or exceed specified requirements at specified operating conditions and that the installation complies with regulatory requirements. Submit summary and results of shop tests performed in accordance with NFPA 20
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Pump Gaskets/Screens/Seals: One set for each different pump model.

#### **1.05 QUALITY ASSURANCE**

- A. Comply with NFPA 13 and NFPA 20; where requirements differ comply with the most stringent.
- B. Equipment and Components: Bearing UL (DIR) label or marking.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with documented experience and approved by the manufacturer.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.
- B. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.
- C. Provide temporary inlet and outlet caps, and maintain in place until installation.

### **PART 2 PRODUCTS**

#### **2.01 FIRE PUMPS**

- A. Manufacturers:
  - 1. AC Fire Pump, a xylem brand: [www.acfirepump.com/#sle](http://www.acfirepump.com/#sle).
  - 2. Patterson Pump Company, a Gorman-Rupp Company: [www.pattersonpumps.com/#sle](http://www.pattersonpumps.com/#sle).
  - 3. Peerless Pump Company: [www.peerlesspump.com/#sle](http://www.peerlesspump.com/#sle).
  - 4. SPP Pumps, Inc: [www.spppumps.com/#sle](http://www.spppumps.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fire Pumps: Vertical in-line type; UL 448 and UL 778; single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 250 psi.
  - 1. Casing: Cast or ductile iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
  - 2. Impeller: Bronze, fully enclosed, keyed directly to motor shaft.
  - 3. Shaft: Solid alloy steel with bronze sleeve.
  - 4. Performance: Refer to Plans.
- C. Accessories:
  - 1. Suction pressure gauge, 4-1/2 inch diameter dial with snubber, valve cock and lever handle.
  - 2. Discharge pressure gauge mounted on board attached to pump, with snubber, valve cock and lever handle.
  - 3. 3/4 inch casing relief valve.
  - 4. Hose valve manifold with 2-1/2 inch hose gate valves with caps and chains.

## **2.02 ELECTRIC MOTOR DRIVE:**

- A. Motor: Squirrel cage induction type, NEMA MG 1; in open drip proof NEMA 250 enclosure, 3500 rpm. Refer to Section 21 0513.
- B. Controller: Limited service type with reduced voltage, starter, in NEMA 250 enclosure, including the following:
  - 1. Disconnect Switch: Externally operable, quick break type.
  - 2. Circuit Breaker: Comply with NFPA 20; minimum 65,000 amperes interrupting capacity.
  - 3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
  - 4. Test Accessories: Ammeter test link and voltmeter test studs.
  - 5. Switch Relay: For remote start.
  - 6. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic".

## **2.03 PRESSURE BOOSTER (JOCKEY) PUMP**

- A. Manufacturers:
  - 1. Armstrong Pumps Inc: [www.armstrongpumps.com/#sle](http://www.armstrongpumps.com/#sle).
  - 2. Grundfos: [www.us.grundfos.com/#sle](http://www.us.grundfos.com/#sle).
  - 3. Talco Fire Systems: [www.talcofire.com/#sle](http://www.talcofire.com/#sle).
  - 4. Goulds: [www.gouldspumps.com](http://www.gouldspumps.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Electrically operated, horizontal turbine type with standard open drip-proof horizontal motor.
- C. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with NFPA 20.
- B. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.
- C. Install piping in accordance with Section 21 0500. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.



- D. Provide drains for bases and seals, piped to and discharging into floor drains.
- E. Provide for connection to electrical service. Refer to Section 26 0583.
- F. Lubricate pumps before start-up.
- G. Check, align, and certify pumps by qualified installer prior to start-up.

### **3.02 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.
- B. Perform hydrostatic tests, flushing, and field acceptance tests as specified in NFPA 20.
- C. Perform field acceptance tests in the presence of Fire Marshal.

### **3.03 CLOSEOUT ACTIVITIES**

- A. Demonstration:
  - 1. Demonstrate automatic operation of system including verification of pressure switch set points to Owner.
  - 2. Use operation and maintenance data as reference during demonstration.
  - 3. Briefly describe function, operation, and maintenance of each component.
- B. Training: Train Owner's personnel on operation and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Location: At project site.

**END OF SECTION**

**SECTION 22 0005**  
**BASIC PLUMBING REQUIREMENTS**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. This section applies to all sections of Division 22.
- B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.
- C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

**1.02 APPLICATION**

- A. This section applies to all plumbing work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.
- B. The plumbing contractor is responsible for the installation and operation of the plumbing systems.
- C. The plumbing contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

**1.03 INSPECTION OF SITE**

- A. Each Contractor shall visit the site prior to bid submission to determine all existing conditions that may affect his work and shall make appropriate allowances for such conditions in his bid. Failure to visit the site shall not be cause for a request for additional compensation later in the project during construction.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.
- C. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- D. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

**1.04 ALTERNATES AND SUBSTITUTIONS**

- A. Refer to Division 01 - General Requirements for procedures to submit products by a Manufacturer that is not listed as approved equal in the Specifications.

**1.05 DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER**

- A. Products identified within the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should Division 22 Contractor submit products by a manufacturer other than that indicated as Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design and coordination of any differing dimensions and clearances with all other trades. This evaluation shall be included as part of the proposed product submittal.

**1.06 MATERIALS**

- A. Plumbing equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.
- B. The Plumbing trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22 of these specifications, including all wiring devices, transformers, conduit, etc. Any conduits used for control wiring shall meet the

specifications as indicated in Division 26.

- C. Power wiring 120 volts and greater shall be by the Electrical Trades.

#### **1.07 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for plumbing work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 22 shall be the latest issue, unless otherwise noted.
- B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

#### **1.08 MAINTENANCE**

- A. Provide 8 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.
- B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manuals shall be submitted in electronic format for review. When approved, four (4) bound hard copies and an indexed electronic PDF shall be provided to the owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

#### **1.09 WARRANTY AND GUARANTEE**

- A. Contractor shall guarantee all work installed by him or his subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

#### **1.10 SUBMITTALS**

- A. Shop drawings and samples shall be submitted in compliance with the Conditions of the Contract and Division 1 General Requirements.
- B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (plumbing piping, plumbing fixtures, etc.). Refer to other sections of the electrical specifications for additional requirements.
- C. Shop Drawings: Each piece of equipment shall be identified by the number shown in the schedules and by specification article number pertaining to the item. Shop drawings shall as a minimum be ¼" equals 1' 0" scale, and shall be newly prepared by the Contractor and not reproduced from the Architect's drawings. Layouts shall be made for all floor plans including all ductwork, piping, electrical distribution and other mechanical equipment. Layouts shall show clearances of piping, ducts, etc., above floor.
- D. Contractor shall obtain Engineer's approval on all the work before any equipment is purchased, or any work installed. Contractor shall also secure approval of the Governmental Authorities having jurisdiction on all equipment and on the layout of the complete system.

- E. The Engineer's review and approval of shop drawings is a gratuitous assistance and in no way does it relieve the Contractor from responsibility for errors or omissions which may exist on the shop drawings. Where such errors or omissions are discovered later, they must be made good by the Contractor, without any additional cost to the Owner, irrespective of any approval by the Engineer.
  - 1. The Contractor shall incorporate with his shop drawings, a letter indicating all deviations from the plans and/or specifications. If in the opinion of the Architect, the deviations are not equal, the Contractor will be required to furnish the item as specified and as indicated on the drawings.
  - 2. Record documents shall be submitted in compliance with the requirements of the Specifications.
- F. Engineer WILL NOT REVIEW:
  - 1. Submittals not specified.
  - 2. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.
  - 3. Submittals made after work is delivered to site and/or installed.
  - 4. Submittal resubmissions unless resubmission is required by Architect/Engineer.
- G. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.
- H. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from errors in submittals.
- I. For underground piping, record dimensions and invert elevations of all piping, including all offsets, fittings, cathodic protection and accessories. Locate dimensions from benchmarks that will be preserved after construction is complete.

#### **1.11 RECORD DRAWINGS**

- A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.
- B. Contractor shall provide the following record drawings as part of the Project closeout document process:
  - 1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
  - 2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

#### **1.12 QUALITY ASSURANCE**

- A. Other referenced standards:
  - 1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE.

### **PART 2 PRODUCTS**

#### **2.01 SLEEVES AND ESCUTCHEONS**

- A. Provide sleeves wherever pipes pass through exterior wall and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleeves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit within the sleeve shall be sealed at each installation with a 3M approved sealant.

#### **2.02 DIELECTRIC UNIONS**

- A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.
- B. Dielectric waterway fittings shall be a copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service.

#### **2.03 BUILDING ATTACHMENTS FOR PLUMBING WORK SUPPORTS**

- A. General Requirements:
  - 1. Provide building attachments required for supporting plumbing work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
  - 2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
  - 3. If specially designed building attachments are required, retain the services of a licensed structural engineer to design such building attachments.
  - 4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
  - 5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.
- B. Attachments to Structural Steel:
  - 1. Support plumbing work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
    - a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
    - b. Side beam clamp with retaining clips - for loads up to 120 lb.
- C. Cast in Place Concrete Inserts:
  - 1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#
- D. Drilled Insert Anchors:
  - 1. Where plumbing work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Existing piping: when encountered during the course of work, protect, brace and support existing piping where required for proper execution of the work.
- B. Interruption of existing active piping: when the course of work makes shut-down of services unavoidable, the plumbing contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.
- C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderly fashion.
- D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

### **3.02 INTERPRETATION OF CONTRACT DOCUMENTS**

- A. Should there be discrepancy or a question of intent, refer matter to Architect/Engineer for decision before ordering any equipment or materials or before starting any related work.
- B. Drawings and Specifications are to be taken together. Work specified and not shown or work shown and not specified shall be performed or furnished as though mentioned in both Specifications and Drawings. If there is discrepancy between Drawings and Specifications as to quantity or quality to be provided, the greater quantity or better quality shall be provided.
- C. Minor items and accessories or devices reasonably inferable as necessary to complete and proper installation and operation of any system shall be provided by Contractor for such

system whether or not specifically called for by Specifications or Drawings.

- D. Architect/Engineer may change location of any equipment 5' and any piping, ductwork, conduit, etc. 10' in any direction without extra charge, provided such changes are made before installation.
- E. Locations of items not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to review and approval by Architect/Engineer.
- F. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.
  - 1. Where headroom or space conditions appear inadequate, notify Architect or Owner's field representative before proceeding with installation.
  - 2. Pipe/duct rerouting and size changes shall be made at no additional cost to the Owner.
- G. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit installation of other work without delay.
- H. Where there is evidence that parts of the Work specified in Divisions 21, 22, and 23 will interfere with other work, assist in working out space conditions to make satisfactory adjustments, revise and submit coordinated shop drawings.
- I. After review and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other sections or for proper execution of the work.
- J. Work installed before coordinating with other work so as to cause interference with other work shall be changed and corrected without additional cost to the Owner.
- K. Drawings are diagrammatic in nature and are a graphic representation of requirements and shall be followed as closely as actual building construction will permit. All changes from the plans necessary to make the work conform to the building as constructed and to fit the work of other trades or to conform to rules of the Governmental Authorities having jurisdiction, NFPA, OSHA and the Owner's Insurance Underwriters, shall be made by the Contractor without extra cost to the Owner.
- L. The layout of the piping, ductwork, equipment, etc., as shown on the drawings shall be checked and exact locations shall be determined by the dimensions of the equipment approved and the Contractor shall obtain approval for the revised layout before the apparatus is installed. The Contractor shall field measure or consult existing record Architectural and Structural Drawings if available for all dimensions, locations of partitions, locations and sizes of structural supports, foundations, etc.
- M. Omission in the Drawings and/or Specifications of any items necessary for the proper completion or operation of the work outlined in this specification shall not relieve the Contractor from furnishing same without additional cost to the Owner.
- N. The Equipment Shop Drawings should be furnished to the installing Contractor by the purchasing Contractor before roughing in. Contractor shall not install any piping or ductwork for said equipment until he has received approved shop drawings for same.

### **3.03 ALTERATIONS IN PRESENT BUILDING AND SYSTEMS**

- A. Contractor shall take particular note of the revisions and alterations to the existing systems, facilities and equipment due to the new construction as indicated on the Drawings and/or in Specification. Contractor shall remove, reroute or alter all services, ductwork, etc., as required or as indicated on the drawings.
- B. The Contractor shall maintain all services in the existing building. In case, where new service connections are to be made to existing services and service interruptions can in no way be avoided, the service interruptions shall be with the minimum of inconvenience to the Owner and the work shall be done at such time of any day, Saturday and Sunday included, and only as directed by the Owner or the Architect.

### **3.04 ACCESSIBILITY**

- A. Do not locate traps, valves, controls, unions, cleanouts, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in plumbing systems.

### **3.05 ACCESS PANELS:**

- A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.
- B. Submit shop drawings for review before ordering panels. Where fire rating is required, furnish label doors compatible with fire rating of assembly.
- C. Contractor shall confer with other trades with respect to access panel locations, and shall wherever practical group valves, traps, dampers, etc. in such way as to be accessible from single panel and eliminate as many access panels as possible.
- D. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.
- E. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials.

### **3.06 PROTECTION OF ELECTRICAL EQUIPMENT**

- A. Contractor shall furnish and install sheet metal drain pans beneath piping that is routed above electrical equipment and/or above the 3' access space in front of such equipment. Electrical equipment, for the purpose of addressing drain pan requirements, shall be defined as free-standing or wall-mounted switchgear, transformers, distribution boards or motor control centers.
  - 1. Drain pans shall be 20 gauge galvanized sheet metal with a minimum 4" high turned up edge. Bottom of drain pan shall slope to a single drainage point at  $\frac{1}{8}$ " per foot. A 1" diameter clear plastic tube shall allow collected fluid to drain to the nearest open site floor drain. Secure plastic tubing to building structure only.
  - 2. Drain pan shall be hung from building structure with angle iron trapeze hangers (no hanger shall penetrate the drain pan). Consider drain pan to be full of water for hanger load calculations.
  - 3. Drain pans shall include liquid detectors with alarms only if noted on the drawings. Liquid detectors shall be specified in Section 22 10 06 Plumbing Piping Specialties.
- B. Contractor shall include provisions to adjust the local lighting layout, at no extra cost to Owner, in order to accommodate any detrimental effect the drain pan has on the illumination of the electrical equipment and access space.

### **3.07 CUTTING, PATCHING AND DAMAGE TO OTHER WORK**

- A. Refer to Division 01 - General Requirements.
- B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.
- C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

### **3.08 EXCAVATION AND BACKFILLING**

- A. Provide all excavation, trenching, tunneling, removal of materials, de-watering and backfilling required for the proper laying of pipes and plumbing work. Coordinate the work with other excavating and backfilling in same area.

### **3.09 ROUGH-IN FOR CONNECTION TO EQUIPMENT**

- A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

### **3.10 MATERIAL AND EQUIPMENT**

- A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

### **3.11 SEAL PENETRATIONS**

- A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

### **3.12 SOUND CONTROL**

- A. Penetrations shall be maintained airtight to prevent sound transfer.
- B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

### **3.13 FIRESTOPPING**

- A. Refer to Division 07 - Thermal and Moisture Protection for more information.
- B. Provide UL classified firestopping system for plumbing penetrations through rated walls and floors to maintain the fire rating.

### **3.14 CONTROL WIRING**

- A. All control wiring for plumbing and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

### **3.15 CLEANING, FLUSHING, AND INSPECTING**

- A. Refer to Division 01 - General Requirements; all plumbing equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.
- B. Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- C. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less than 4' per second and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.
- D. Inspect pressure piping in accordance with procedures of ASME B31.

### **3.16 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS**

- A. Refer to Division 01 - General Requirements; all equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.
- B. On-site storage shall be coordinated with Construction Manager/General Contractor and be performed in a manner as to avoid damage, deterioration and loss.
- C. Contractor shall provide temporary protection for installed equipment prior to project completion.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.
- F. Protect plumbing fixtures and piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### **3.17 PIPING TESTS**

- A. Test pressure piping in accordance with ASME B31.



- B. General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
1. Test each piping system at 150% of operating pressure, or other pressure as required by Authority Having Jurisdiction, whichever is greater.
    - a. Domestic water systems and equipment vents shall be tested hydrostatically for minimum of four hours at 1½ times design pressure for that system, or 100 psig minimum, whichever is greater, unless otherwise specified.
    - b. Storm, soil, waste and vent piping shall be tested with water for minimum of 24 hours at 10 feet head.
    - c. Acid resistant waste and vent systems shall be tested as per manufacturer's recommendations.
  2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.
- D. Drain test water from piping systems after testing and repair work has been completed.

**END OF SECTION**

**SECTION 22 0519  
METERS AND GAUGES FOR PLUMBING PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.

**1.02 REFERENCE STANDARDS**

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014, with Editorial Revision (2017).
- D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

**1.04 FIELD CONDITIONS**

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

**PART 2 PRODUCTS**

**2.01 PRESSURE GAUGES**

- A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
  - 1. Case: Steel with brass bourdon tube.
  - 2. Size: 4-1/2 inch diameter.
  - 3. Mid-Scale Accuracy: One percent.
  - 4. Scale: Psi and kPa.

**2.02 PRESSURE GAUGE TAPPINGS**

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

**2.03 STEM TYPE THERMOMETERS**

- A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
  - 1. Size: 9 inch scale.
  - 2. Window: Clear Lexan.
  - 3. Accuracy: 2 percent, per ASTM E77.
  - 4. Calibration: Degrees F.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.
- C. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- D. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

**3.02 SCHEDULES**

- A. Pressure Gauges, Location and Scale Range:
  - 1. Pumps, 0 to 120 psi.
  - 2. Pressure reducing valves, 0 to 120 psi.
- B. Stem Type Thermometers, Location and Scale Range:
  - 1. Domestic hot water supply and recirculation, 0 to 180 degrees F.

**END OF SECTION**

**SECTION 22 0523  
GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Applications.
- B. General requirements.
- C. Ball valves.
- D. Butterfly valves.
- E. Check valves.
- F. Gate valves.
- G. Manual balancing valves.
- H. Automatic balancing valves.
- I. Pressure reducing valves.
- J. Plug valves.
- K. Drain valves.
- L. Relief valves.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 3100 - Access Doors and Panels.
- B. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- C. Section 22 0719 - Plumbing Piping Insulation.
- D. Section 22 1005 - Plumbing Piping.

**1.03 ABBREVIATIONS AND ACRONYMS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. PTFE: Polytetrafluoroethylene.
- E. TFE: Tetrafluoroethylene.

**1.04 REFERENCE STANDARDS**

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2017.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- F. ASME B16.34 - Valves - Flanged, Threaded and Welding End 2017.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- I. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).
- J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- K. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- M. AWWA C606 - Grooved and Shouldered Joints 2015.

- N. MSS SP-67 - Butterfly Valves 2017.
- O. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends 2011.
- P. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends 2018.
- Q. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- R. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends 2011.
- S. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves 2013.
- T. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- U. NSF 61 - Drinking Water System Components - Health Effects 2020.
- V. NSF 372 - Drinking Water System Components - Lead Content 2020.

## **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Grooved joint valves shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.

## **1.06 QUALITY ASSURANCE**

- A. Manufacturer:
  - 1. Obtain valves for each valve type from single manufacturer.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Grooved end valves shall be of the same manufacturer as the adjoining couplings.
- D. All castings used for valve bodies shall be date stamped for quality assurance and traceability.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Use the following precautions during storage:
  - 1. Maintain valve end protection and protect flanges and specialties from dirt.
    - a. Provide temporary inlet and outlet caps.
    - b. Maintain caps in place until installation.

## **PART 2 PRODUCTS**

### **2.01 APPLICATIONS**

- A. Provide the following valves for the applications if not indicated on drawings:
  - 1. Shutoff: Ball or butterfly.
    - a. Gate valves shall only be used on shut off for pumped sanitary/storm piping only.
    - b. Plug valves or ball valves can be used for natural gas shutoff.
  - 2. Dead-End: Single-flange butterfly (lug) type.
  - 3. Swing Check:
    - a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    - b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
    - c. 2-1/2 NPS and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
  - 4. Spring Loaded Check: At pump discharge.
  - 5. Automatic Balancing Valves: At all domestic hot water connections to hot water return piping.
  - 6. Manual Balancing Valves: At hot water return pump discharge only.
- B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- C. Required Valve End Connections for Non-Wafer Types:
  - 1. Steel Pipe:
    - a. 2 NPS and Smaller: Threaded ends.

- b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
    - c. 5 NPS and Larger: Grooved or flanged ends.
    - d. Grooved-End Copper Tubing and Steel Piping: Grooved.
  - 2. Copper Tube:
    - a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
    - b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
    - c. 5 NPS and Larger: Grooved or flanged ends.
- D. Domestic, Hot and Cold Water Valves:
  - 1. 2 NPS and Smaller:
    - a. Bronze: Provide with solder-joint or threaded ends.
    - b. Ball: Two piece, full port, bronze with bronze or stainless steel trim.
      - 1) Heat treated DZR brass valves by Jomar are allowed as specified below.
    - c. Bronze Swing Check: Class 125, bronze disc.
  - 2. 2-1/2 NPS and Larger:
    - a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
    - b. Iron Ball: Class 150.
    - c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
    - d. Grooved End, Cast Brass Butterfly: 300 CWP, Fluoroelastomer pressure-responsive seat, aluminum-bronze disc.
- E. Sanitary Waste and Storm Drainage Water Valves:
  - 1. 2 NPS and Smaller:
    - a. Bronze: Provide with solder-joint or threaded.
    - b. Ball: Two piece, full port, bronze with bronze or stainless steel trim.
    - c. Bronze Spring Loaded Check: Class 125, nonmetallic disc.
    - d. Bronze Gate: Class 125, NRS.
  - 2. 2-1/2 NPS and Larger:
    - a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
    - b. Iron Ball: Class 150.
    - c. Iron Swing Check with Closure Control: Class 125, lever and spring.
    - d. Iron Gate: Class 125, NRS.
- F. Natural Gas Valves:
  - 1. Ball Valve: 4 NPS and Smaller:
    - a. Bronze: Provide with solder-joint or threaded ends with union.
    - b. Ball: Class 150, regular port, teflon seats.
  - 2. Plug: 2-1/2 NPS and Larger:
    - a. Lubricated Plug: Class 125, regular gland.

## 2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
  - 1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
  - 2. Handwheel: Valves other than quarter-turn types.
  - 3. Hand Lever: Quarter-turn valves 6 NPS and smaller.
- D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
  - 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 2. Butterfly Valves: Extended neck.
  - 3. Memory Stops: Fully adjustable after insulation is installed.
- E. Valve-End Connections:
  - 1. Threaded End Valves: ASME B1.20.1.
  - 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.

3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
  4. Solder Joint Connections: ASME B16.18.
  5. Grooved End Connections: Copper-tube dimensions, similar to AWWA C606.
- F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
  2. Solder-joint Connections: ASME B16.18.
  3. Building Services Piping Valves: ASME B31.9.
- G. Valve Materials for Potable Water: NSF 61 and NSF 372.
- H. Bronze Valves:
1. Fabricate from dezincification resistant material.
  2. Copper alloys containing more than 15 percent zinc are not permitted.
- I. Source Limitations: Obtain each valve type from a single manufacturer.

### **2.03 BRONZE BALL VALVES**

- A. Two Piece, Full Port with Bronze or Stainless Steel Trim:
1. Comply with MSS SP-110.
  2. SWP Rating: 150 psig.
  3. CWP Rating: 600-1000 psig.
  4. Body: Lead Free Bronze.
  5. Ends: Threaded.
  6. Seats: PTFE or TFE.
  7. Manufacturers:
    - a. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
    - b. Nibco: [www.nibco.com](http://www.nibco.com)
  8. Jomar Valves with heat treated DZR brass - CW511 alloy body and end connection and CW510L brass alloy ball and stem and TEA coated ball are allowed.
    - a. Substitutions: See Section 01 6000 - Product Requirements.
- B. For Natural Gas Service: Two Piece, Regular Port with Bronze, Chrome Plated Brass or Stainless Steel Trim:
1. Comply with MSS-SP110.
  2. SWP Rating: 150 psig.
  3. CWP Rating: 400 psig.
  4. Body: Bronze
  5. Ends: Threaded or Solder with union.
  6. Stem: Blow-out proof
  7. Manufacturers:
    - a. Apollo Valves: [www.apollovalves.com](http://www.apollovalves.com)
    - b. Jomar Valves: [www.jomarvalve.com](http://www.jomarvalve.com)
    - c. Viega: [www.viega.us](http://www.viega.us)
    - d. Substitutions: See Section 01 6000-Product Requirements.

### **2.04 IRON BALL VALVES - NOT FOR DOMESTIC**

- A. Class 125, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
  2. CWP Rating: 200 psig.
  3. Body: ASTM A536 Grade 65-45-12, ductile iron.
  4. Ends: Flanged.
  5. Seats: PTFE, TFE, or Teflon.
  6. Operator: Lever, with locking handle.
  7. Manufacturers:
    - a. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
    - b. Ferguson Enterprises Inc: [www.fnw.com/#sle](http://www.fnw.com/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.

### **2.05 IRON, SINGLE FLANGE BUTTERFLY VALVES**

- A. Lug type: Bi-directional dead-end service without use of downstream flange.
1. Comply with MSS SP-67, Type I.
  2. CWP Rating: 200 psig.

3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: EPDM.
6. Disc: Bronze or Stainless Steel.
7. Manufacturers:
  - a. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
  - b. Jomar valves: [www.jomarvalve.com](http://www.jomarvalve.com).
  - c. Nibco: [www.nibco.com](http://www.nibco.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.06 BRASS, GROOVED-END BUTTERFLY VALVES**

- A. Grooved Ends: Bi-directional dead-end service.
  1. CWP Rating: 300 psig.
  2. Body: Cast brass, UNS C87850.
  3. Stem: Stainless steel, offset from the disc centerline to provide complete 360-degree circumferential seating.
  4. Seat: Pressure responsive Fluoroelastomer.
  5. Disc: Aluminum-bronze.
  6. UL classified in accordance with NSF-61 for potable water service, and meets the lead requirements of NSF-372.
  7. Manufacturer: Victaulic

## **2.07 BRONZE SWING CHECK VALVES**

- A. Class 125: CWP Rating: 200 psig (1380 kPa).
  1. Comply with MSS SP-139, Type 3.
  2. Design: Horizontal flow.
  3. Body: Bronze, ASTM B62.
  4. Ends: Threaded or soldered as indicated.
  5. Disc: Lead Free Bronze ASTM B584.
  6. Manufacturers:
    - a. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
    - b. Milwaukee: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
    - c. Jomar: [www.jomarvalve.com](http://www.jomarvalve.com).
    - d. Nobco: [www.nibco.com](http://www.nibco.com)
    - e. Substitutions: See Section 01 6000 - Product Requirements.

## **2.08 BRONZE SPRING LOADED CHECK VALVES**

- A. Class 125: CWP Rating 200 psig (1380 kPa).
  1. Design: Vertical flow.
  2. Body: Bronze, ASTM B61 or ASTM B62
  3. Spring: Bronze
  4. Ends: Threaded or soldered as indicated.
  5. Disc: Nonmetallic
  6. Manufacturers:
    - a. Milwaukee: [www.milwaukeevalve.com](http://www.milwaukeevalve.com)
    - b. Apollo Valves[<>]: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
    - c. Substitutions: See Section 01 6000-Product Requirements.

## **2.09 IRON SWING CHECK VALVES WITH CLOSURE CONTROL**

- A. Class 125 with Lever and Spring-Closure Control.
  1. Comply with MSS SP-71, Type I.
  2. Description:
    - a. CWP Rating: 200 psig.
    - b. Design: Clear or full waterway.
    - c. Body: ASTM A126, gray iron or ductile iron with bolted bonnet.
    - d. Ends: Flanged or threaded as indicated.
    - e. Spring: Stainless steel.
    - f. Trim: Bronze or stainless steel.
    - g. Gasket: Asbestos free.
    - h. Closer Control: Factory installed, exterior lever, and spring.



3. Manufacturers:
  - a. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
  - b. Flomatic Valves: [www.flomatic.com/#sle](http://www.flomatic.com/#sle).
  - c. Nibco: [www.nibcoc.com](http://www.nibcoc.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.10 BRONZE GATE VALVES - PUMPED SANITARY/STORM ONLY**

- A. Non-Rising Stem (NRS) or Rising Stem (RS):
  1. Comply with MSS SP-80, Type I.
  2. Class 125: CWP Rating: 200-285 psig.
  3. Body: ASTM B584 Lead Free, bronze with integral seat and screw-in bonnet.
  4. Ends: Threaded or solder joint .
  5. Stem: Bronze.
  6. Disc: Solid wedge; bronze.
  7. Packing: Asbestos free.
  8. Handwheel: Malleable iron, bronze, or aluminum.
  9. Manufacturers:
    - a. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
    - b. Ferguson Enterprises Inc: [www.fnw.com/#sle](http://www.fnw.com/#sle).
    - c. Jomar Valve: [www.jomarvalve.com](http://www.jomarvalve.com).
    - d. Nibco: [www.nibco.com](http://www.nibco.com)
    - e. Substitutions: See Section 01 6000 - Product Requirements.

## **2.11 IRON GATE VALVES - PUMPED SANITARY/STORM ONLY**

- A. NRS or OS & Y:
  1. Comply with MSS SP-70, Type I.
  2. Class 125: CWP Rating: 200-285 psig.
  3. Body: ASTM A126, gray iron or ductile iron with bolted bonnet.
  4. Ends: Flanged.
  5. Trim: Bronze or stainless steel.
  6. Disc: Solid wedge.
  7. Packing and Gasket: Asbestos free.
  8. Manufacturers:
    - a. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
    - b. Ferguson Enterprises Inc: [www.fnw.com/#sle](http://www.fnw.com/#sle).
    - c. Nibco: [www.nibco.com](http://www.nibco.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.12 PVC COMBINATION CHECK AND BALL VALVE - PUMPED SANITARY/STORM ONLY**

- A. Rated for 25 psi (58 ft of head)
  1. Full flow PVC check valve, ball valve, union combination
  2. Gasket & Flapper: Neoprene, replaceable flapper
  3. Backing plates & rivet: Stainless steel
  4. Screws: Stainless steel
  5. Manufacturers:
    - a. Zoeller: [www.zoellerpumps.com](http://www.zoellerpumps.com)
    - b. Manufacturer of sanitary/storm pump
    - c. Substitutions: See Section 01 6000-Product Requirements.

## **2.13 LUBRICATED PLUG VALVES**

- A. Regular Gland with Threaded or Flanged Ends.:
  1. Comply with MSS SP-78, Type II.
  2. Class 125: CWP Rating: 200 psig.
  3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
  4. Pattern: Regular or short.
  5. Plug: Cast iron or bronze with sealant groove.
  6. Manufacturers:
    - a. Homestead: [www.homesteadvalve.com](http://www.homesteadvalve.com).
    - b. Norgas Controls: [www.norgascontrols.com](http://www.norgascontrols.com).
    - c. Flowserve Corporation: [www.flowserve.com](http://www.flowserve.com).

- d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.14 MANUAL BALANCING VALVES**

- A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.
- C. Manufacturers:
  - 1. ITT Bell & Gossett: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  - 2. Griswold Controls: [www.griswoldcontrols.com/#sle](http://www.griswoldcontrols.com/#sle).
  - 3. Taco, Inc: [www.taco-hvac.com/#sle](http://www.taco-hvac.com/#sle).
  - 4. Jomar Valve: [www.jomarvalve.com](http://www.jomarvalve.com)
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

## **2.15 AUTOMATIC BALANCING VALVES**

- A. Thermostatic balancing valves:
  - 1. Manufacturers:
    - a. ITT Bell & Gossett; Temp Setter: [www.bellgossett.com](http://www.bellgossett.com)
    - b. Caleffi; Thermosetter: [www.caleffi.com](http://www.caleffi.com)
    - c. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. The valve shall be certified lead free according to NSF/ANSI 61 standards.
  - 3. The valve body shall be constructed out of 316 stainless steel or DZR low-lead brass
  - 4. The valve shall be rated for 145 PSIG working pressure.
  - 5. The valve shall have a temperature adjustment dial in degrees F. The dial shall have an adjustment range of 98°F (37°C) to 140°F (60°C).
  - 6. The valve shall include a pre-formed thermal insulation block/shell.

## **2.16 WATER PRESSURE REDUCING VALVES**

- A. Valves over 2 inches: ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
  - 1. Manufacturers:
    - a. Amtrol: [www.amtrol.com](http://www.amtrol.com)
    - b. Apollo valves: [www.apollovalves.com](http://www.apollovalves.com)
    - c. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com)
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.17 DRAIN VALVES**

- A. Drain Valve with hose thread and chain and dust cap; chrome plated ball, blow-out-proof stem, and adjustable packing gland.
- B. Manufacturers:
  - 1. Hammond: [www.hammondvalve.com](http://www.hammondvalve.com)
  - 2. Apollo valves: [www.apollovalves.com](http://www.apollovalves.com)
  - 3. Nibco: [www.nibco.com/valves](http://www.nibco.com/valves)
  - 4. Milwaukee: [www.milwaukeevalve.com](http://www.milwaukeevalve.com)
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

## **2.18 RELIEF VALVES**

- A. Pressure Relief Valves: Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.
- B. Manufacturers:
  - 1. CASH (A.W.) Valve Manufacturing Corp: [www.cashvalve.net](http://www.cashvalve.net)
  - 2. Zurn Industries; Wilkins-Regulator Division: [www.zurn.com](http://www.zurn.com)
  - 3. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com)
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- D. Provide access where valves and fittings are not exposed.
- E. Install check valves where necessary to maintain direction of flow as follows:
  - 1. Spring Loaded Check: Install with stem plumb and vertical.
  - 2. Swing Check: Install horizontal maintaining hinge pin level.
- F. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.
- G. Install valves with stems upright or horizontal, not inverted.

**END OF SECTION**

**SECTION 22 0553**  
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

**1.02 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.

**PART 2 PRODUCTS**

**2.01 IDENTIFICATION APPLICATIONS**

- A. Piping: Pipe markers.
- B. Pumps: Nameplates.
- C. Equipment and Tanks: Nameplates.
- D. Valves: Tags.

**2.02 NAMEPLATES**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 2. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Laminated three-layer plastic with engraved letters.

**2.03 TAGS**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 2. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

**2.04 PIPE MARKERS**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 2. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

**3.02 INSTALLATION**

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
  - 1. Install in clear view and align with axis of piping.
  - 2. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

**END OF SECTION**

**SECTION 22 0719  
PLUMBING PIPING INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Piping insulation.
- B. Jackets and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

**1.03 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

**PART 2 PRODUCTS**

**2.01 REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

**2.02 GLASS FIBER**

- A. Manufacturers:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Johns Manville Corporation: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 3. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
  - 4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
  - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
  - 2. Maximum Service Temperature: 850 degrees F.
  - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.

1. Vapor Barrier Lap Adhesive shall be compatible with the insulation and as recommended by the insulation manufacturer.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- G. Indoor Vapor Barrier Finish:
  1. Vinyl emulsion type acrylic, compatible with insulation, white color.

## **2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

- A. Manufacturers:
  1. Aeroflex USA, Inc: [www.aeroflexusa.com/#sle](http://www.aeroflexusa.com/#sle).
  2. Armacell LLC: [www.armacell.us/#sle](http://www.armacell.us/#sle).
  3. K-Flex USA LLC: [www.kflexusa.com/#sle](http://www.kflexusa.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
  1. Minimum Service Temperature: Minus 40 degrees F.
  2. Maximum Service Temperature: 220 degrees F.
  3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

## **2.04 JACKETS**

- A. PVC Plastic.
  1. Manufacturers:
    - a. Johns Manville Corporation: [www.jm.com/#sle](http://www.jm.com/#sle).
    - b. Proto Corporation: [www.protocorporation.com](http://www.protocorporation.com).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
  2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil.
    - e. Connections: Brush on welding adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
  1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
  1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- H. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### **3.03 SCHEDULES**

- A. Plumbing Systems:
  1. Domestic Hot Water Supply & Recirculation:
    - a. Pipe Size Range: 1/2 to 1-1/4 inch
      - 1) Thickness: 1 inch
    - b. Pipe Size Range: 1-1/2 to 8 inch
      - 1) Thickness: 1-1/2 inch
  2. Domestic Cold Water: 1 inch thick.
  3. Roof Drain Bodies: 1/2 inch thick.
  4. Roof Drainage Above Grade: 1/2 inch thick with PVC jacket.
  5. Plumbing Vents Within 10 Feet of the Exterior: 1/2 inch thick with PVC jacket.
- B. Cooling Systems:
  1. Condensate Drains from Cooling Coils: 1 inch thick.
- C. Other Systems:
  1. Piping Exposed to Freezing with Heat Tracing: 1 inch or as recommended by heat tracing manufacturer.

**END OF SECTION**



**SECTION 22 1005  
PLUMBING PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
  - 1. Sanitary sewer.
  - 2. Domestic water.
  - 3. Storm water.
  - 4. Natural gas.
  - 5. Condensate drains.
  - 6. Flanges, unions, and couplings.
  - 7. Pipe hangers and supports.
  - 8. Manufactured sleeve-seal systems.

**1.02 RELATED REQUIREMENTS**

- A. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
- B. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- C. Section 22 0719 - Plumbing Piping Insulation.

**1.03 REFERENCE STANDARDS**

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV 2017.
- E. ASME B31.1 - Power Piping 2020.
- F. ASME B31.9 - Building Services Piping 2020.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- H. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- J. ASTM B32 - Standard Specification for Solder Metal 2020.
- K. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2016.
- M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2018.
- N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- P. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.
- Q. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.
- R. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2017.
- S. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- T. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- U. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and

Piping Components with Tapered Sockets 2020.

- V. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2016.
- W. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.
- X. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
- Y. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).
- Z. AWWA C651 - Disinfecting Water Mains 2014.
- AA. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications 2017 (Revised 2018).
- BB. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2012 (Revised 2018).
- CC. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- DD. NSF 61 - Drinking Water System Components - Health Effects 2020.
- EE. NSF 372 - Drinking Water System Components - Lead Content 2020.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
  - 1. Grooved joint couplings and fittings shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with applicable codes.
- B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.
- C. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
  - 1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### **1.07 FIELD CONDITIONS**

- A. Do not install underground piping when bedding is wet or frozen.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL REQUIREMENTS**

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

#### **2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

- C. PVC Pipe: ASTM D2665 or ASTM D3034. Solid wall
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

### **2.03 SANITARY SEWER PIPING, ABOVE GRADE**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

### **2.04 SANITARY SEWER AND STORM WATER PIPING, PUMPED**

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method
  - 1. Fittings (Pressure):
    - a. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
    - b. Cast-Iron Flanges: ASME B16.1, Class 125.
    - c. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
  - 2. Joints: Threaded.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B).
  - 1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, solvent.
  - 2. Joints: ASTM B32, alloy Sn50 solder.
- C. PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR 26 with not less than 150 psi pressure rating.
  - 1. Fittings: ASTM D2466, PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

### **2.05 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Copper Pipe: ASTM B42, hard drawn.
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
  - 1. Fittings: Ductile iron, standard thickness.
  - 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

### **2.06 DOMESTIC WATER PIPING, ABOVE GRADE**

- A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
  - 1. Fittings:
    - a. ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
    - b. Grooved end fittings manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)
  - 2. Joints:
    - a. ASTM B32, alloy Sn95 solder.
    - b. Grooved joint coupling consisting of two ductile iron housings cast with offsetting angle-pattern bolt pads, Fluoroelastomer center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, and ASTM A449 compliant bolts and nuts. Installation ready rigid coupling for direct stab installation without field disassembly.
      - 1) UL classified in accordance with NSF-61 for potable water service. The system shall meet the low-lead requirements of NSF-372.
  - 3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
    - a. Manufacturers:
      - 1) Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
      - 2) Viega LLC: [www.viega.us/#sle](http://www.viega.us/#sle).
      - 3) Nibco: [www.nibco.com](http://www.nibco.com).
      - 4) Substitutions: See Section 01 6000 - Product Requirements.

### **2.07 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
  - 1. Fittings: Cast iron.
  - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. PVC Pipe: ASTM D2665 or ASTM D3034. Solid wall
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

## **2.08 SUB-SOIL DRAINAGE PIPING - DRAIN TILE**

- A. PVC Pipe: ASTM D2729 perforated polyvinyl chloride pipe and fittings.
  - 1. Filter Sock: ASTM D6707 Machine knitted polyester filter sock.

## **2.09 STORM WATER PIPING, ABOVE GRADE**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

## **2.10 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
  - 1. Fittings: ASTM A234/A234M, wrought steel welding type.
  - 2. Joints: ASME B31.1, welded.
  - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
- B. Polyethylene Pipe: ASTM D2513, SDR 11.
  - 1. Fittings: ASTM D2683 or ASTM D2513 socket type.
  - 2. Joints: Fusion welded.
  - 3. Install per manufacturer recommendations and provide with tracer wire.

## **2.11 NATURAL GAS PIPING, ABOVE GRADE**

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
  - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
  - 2. Joints: Threaded or welded to ASME B31.1.

## **2.12 CONDENSATE DRAINS SERVING INDIVIDUAL EQUIPMENT**

- A. Copper Tube: ASTM B88 (ASTM B88M), Tyle L (B), drawn; using one of the following joint types:
  - 1. Solder joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

## **2.13 CONDENSATE DRAINAGE SYSTEMS SERVING MULTIPLE PIECES OF EQUIPMENT.**

- A. Copper Tube: ASTM B88 (ASTM B88M), Tyle L (B), drawn; using one of the following joint types:
  - 1. Solder joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

## **2.14 FLANGES, UNIONS, AND COUPLINGS**

- A. Unions for Pipe Sizes 3 Inches and Under:
  - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
  - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
  - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

- C. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.
- D. No-Hub Couplings:
  - 1. General: Comply with ASTM C1277 and CISPI 310.
  - 2. Gasket Material: Neoprene complying with ASTM C564.
  - 3. Band Material: Stainless steel complying with ASTM A240.
  - 4. Eyelet Material: Stainless steel.
  - 5. Manufacturers:
    - a. MIFAB, Inc: [www.mifab.com/#sle](http://www.mifab.com/#sle).
    - b. Anaco-Husky: [www.anaco-husky.com](http://www.anaco-husky.com).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- E. Dielectric Connections:
  - 1. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
  - 2. Waterway Fitting: Copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service. Fittings shall have threaded ends, grooved ends, or a combination.

## **2.15 PIPE HANGERS AND SUPPORTS**

- A. Provide hangers and supports that comply with MSS SP-58.
  - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
  - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
  - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
  - 4. Vertical Pipe Support: Steel riser clamp.

## **2.16 MANUFACTURED SLEEVE-SEAL SYSTEMS**

- A. Manufacturers:
  - 1. The Metraflex Company: [www.metraflex.com/#sle](http://www.metraflex.com/#sle).
  - 2. CALPICO: [www.calpicoinc.com](http://www.calpicoinc.com).
  - 3. Advanc Products & Systems, Inc.: [www.apsonline.com](http://www.apsonline.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Modular/Mechanical Seal:
  - 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
  - 2. Provide watertight seal between pipe and wall/casing opening.
  - 3. Elastomer element size and material in accordance with manufacturer's recommendations.
  - 4. Glass reinforced plastic pressure end plates.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges, grooved joint couplings, or unions.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions. Cast iron soil pipe installed in accordance to CISPI's Handbook.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access door with Division 01.
- I. Establish elevations of buried piping outside the building to ensure not less than 4 ft of cover.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.
- L. Install water piping to ASME B31.9.
- M. Slope water piping and arrange to drain at low points.
- N. Install sub-soil drainage piping (perforated) from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubs and groove end of units up-stream. Lay perforated pipe with perforations down.
- O. Sub-soil drain pipe tube or tile shall be laid in trench with a minimum of 6" gravel on all sides. Provide filter sock and/or filter fabric on pipe.
- P. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- Q. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.
- R. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- S. Sleeve pipes passing through partitions, walls, and floors.
- T. Manufactured Sleeve-Seal Systems:
  - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
  - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
  - 3. Locate piping in center of sleeve or penetration.
  - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
  - 5. Tighten bolting for a watertight seal.
  - 6. Install in accordance with manufacturer's recommendations.
- U. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- V. In general, all piping, and similar items shall be installed concealed from view above ceiling, in partitions, shafts, chases, unless otherwise indicated.
- W. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space. If conflicts arise making this impossible, obtain instructions from Architect/Engineer before proceeding with work.
- X. Where there is evidence that plumbing work will interfere with other work, assist in working out space conditions and/or structure, make necessary adjustments to accommodate work.
- Y. Plumbing work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.

- Z. Appliances and equipment to be installed and connected with best engineering practices and in accordance with manufacturer's instructions and recommendations. Piping, valves, connections and other like items recommended by manufacturer or as required for proper operation to be provided without additional cost to Owner.
- AA. In no case will any pipe, conduit or duct be installed where it is supported on or suspended from another pipe, conduit or duct.

### **3.03 APPLICATION**

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

### **3.04 TOLERANCES**

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope; 1/4 inch per foot slope for piping serving low flow fixtures.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### **3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### **3.06 SERVICE CONNECTIONS**

- A. Provide new sanitary and storm sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new natural gas service. Coordinate incoming line size, meter location, regulator settings, etc. with Utility Company prior to the start of any work.
- C. Provide new water service complete with approved wye strainer, reduce pressure backflow preventer, and water meter with by-pass valves.
  - 1. Provide 18 gage, 0.0478-inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

**END OF SECTION**

**SECTION 22 1006  
PLUMBING PIPING SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Washing machine boxes and valves.
- F. Ice machine valve and recessed box.
- G. Air admittance valves.
- H. Back water valves.
- I. Backflow preventers.
- J. Strainers.
- K. Water hammer arrestors.
- L. Sanitary waste interceptors.
- M. Mixing valves.
- N. Pump connectors.
- O. Air Vents.
- P. Trap seals.
- Q. Natural gas regulators.
- R. Leak detection systems.

**1.02 RELATED REQUIREMENTS**

- A. Section 22 1005 - Plumbing Piping.
- B. Section 22 3000 - Plumbing Equipment.
- C. Section 22 4000 - Plumbing Fixtures.

**1.03 REFERENCE STANDARDS**

- A. ASME A112.6.3 - Floor and Trench Drains 2019.
- B. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2008 (Reaffirmed 2012).
- C. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers 2011.
- D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- E. NSF 61 - Drinking Water System Components - Health Effects 2020.
- F. NSF 372 - Drinking Water System Components - Lead Content 2020.
- G. PDI-WH 201 - Water Hammer Arresters 2017.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, and other specialties applicable to project.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Loose Keys for Outside Hose Bibbs: One.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**



- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

## **2.02 DRAINS**

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
  2. Josam Company: [www.josam.com/#sle](http://www.josam.com/#sle).
  3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  4. MIFAB: [www.mifab.com](http://www.mifab.com).
  5. Watts: [www.watts.com](http://www.watts.com)
  6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Roof Drains and Overflow Drains:
1. Assembly: ASME A112.6.4.
  2. Body: Lacquered cast iron with sump.
  3. Strainer: Removable low silhouette cast iron dome with vandal proof screws.
  4. Accessories: Coordinate with roofing type:
    - a. Membrane flange and membrane clamp with integral gravel stop.
    - b. Adjustable under deck clamp.
    - c. Roof sump receiver.
    - d. Waterproofing flange.
    - e. Adjustable extension sleeve for roof insulation.
    - f. For Overflow Drain: 2-inch high external water dam.
    - g. Adjustable extension sleeve for roof insulation.
- C. Downspout Nozzles:
1. Bronze round with hinged perforated cover.
- D. Floor Drains:
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, and reversible clamping collar.
  2. Strainer: Refer to Plumbing Fixture Schedule for size, type and accessories.
- E. Floor Sinks:
1. Lacquered cast iron body with ABS anti-splash interior bottom dome strainer, light duty grate with slotted openings, white acid resisting porcelain enamel interior and top.
  2. Size: refer to Plumbing Fixture Schedule.
  3. Grate type: refer to Plumbing Fixture Schedule.
  4. Install with lip approximately 1" above finished floor, if required by AHJ.
- F. Laundry Trough Drain:
1. Stainless steel laundry trough drain with removable stainless steel lint filter and stainless steel mesh over bottom dome strainer.
  2. Size: Refer to Plumbing Fixture Schedule.
  3. Basis of Design: JR Smith- Model SQ-TD-0203

## **2.03 CLEANOUTS**

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
  2. MIFAB, Inc: [www.mifab.com/#sle](http://www.mifab.com/#sle).
  3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Cleanouts at Exterior Surfaced Areas
1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas:
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- D. Cleanouts at Interior Finished Floor Areas:
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
- E. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- F. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

#### **2.04 HOSE BIBBS**

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
  2. Watts Regulator Company: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
  3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Interior Hose Bibbs for Public Areas:
1. Moderate climate, anti-siphon narrow wall hydrant with chrome plated face, integral vacuum breaker, 3/4" hose connection, 360 degree swivel pipe connection with 3/4" female/1" male threads. Bronze head, seat casting, internal working parts, and loose key.
  2. Complies with ASSE 1019.

#### **2.05 HYDRANTS**

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
  2. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  3. Prier: [www.prier.com](http://www.prier.com).
  4. Woodford: [www.woodfirdmfg.com](http://www.woodfirdmfg.com)
  5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall Hydrants:
1. ASSE 1019; freeze resistant, lead free, self-draining type with chrome plated lockable recessed box hose thread spout, lockshield and removable key, and integral vacuum breaker.
- C. Roof Hydrants:
1. Non-freeze roof hydrant with ASSE 1052 double check valve, galvanized casing and adjustable flow wheel lock handle with deck flange and underdeck clamp. Lead free. Route drain to nearest floor drain or mop sink.

#### **2.06 WASHING MACHINE BOXES AND VALVES**

- A. Box Manufacturers:
1. IPS Corporation/Water-Tite: [www.ipscorp.com/#sle](http://www.ipscorp.com/#sle).
  2. Oatey Supply Chain Services, Inc: [www.oatey.com/#sle](http://www.oatey.com/#sle).
  3. Sioux Chief; [www.siouxchief.com](http://www.siouxchief.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Unit shall allow for mounting with supply lines from top or bottom, on-stud or between-studs. Supply and drain boxes can be connected using provided galvanized U-Clip or separated as desired. Supply box can be inverted. Unit shall be available with ASME A112.18.1 1/4-turn valves and ASSE 1010 water hammer arrestors. Metal support bracket shall install into top/bottom tracks of box. Drain box shall have a 5/8" integral testable nipple on knockout. Outlet connections shall be generally 3/4". Outlet connections should generally be provided with a test/tamper-resistant cap. Valves should be plated. Arrestor option handles can be operated together (single throw) or independently.
- C. Boxes shall be fire rated when installed in fire rated walls. Coordinate with Architectural plans.

#### **2.07 ICE MAKER VALVE AND RECESSED BOX**

- A. Box Manufacturers:
1. IPS Corporation/Water-Tite: [www.ipscorp.com/#sle](http://www.ipscorp.com/#sle).
  2. Oatey Supply Chain Services, Inc: [www.oatey.com/#sle](http://www.oatey.com/#sle).
  3. Sioux Chief; [www.siouxchief.com](http://www.siouxchief.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Unit shall allow for mounting with supply lines from top or bottom, on-stud or between-studs. Unit shall be available with ASME A112.18.1 1/4-turn valve and ASSE 1010

water hammer arrestor. Outlet connections shall be generally 1/4". Outlet connections should generally be provided with a test/tamper-resistant cap. Valves should be plated.

- C. Boxes shall be fire rated when installed in fire rated walls. Coordinate with Architectural plans.

## **2.08 AIR ADMITTANCE VALVES**

- A. Manufacturers:
  - 1. IPS Corporation: Studor; [www.ipscorp.com](http://www.ipscorp.com)
  - 2. Sioux Chief: Turbo Vent; [www.siouxchief.com](http://www.siouxchief.com)
  - 3. Oatey: Sure Vent; [www.oatey.com](http://www.oatey.com)
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: ASSE 1050 and 1051; Valve shall provide positive seal at 0 psi and under positive line pressure to prevent sewer gasses from entering the occupied space. ABS/PVC body with Schedule 40 adapter and actuating device.
- C. When device is located in a wall, provide with recessed access box with vented cover plate. Access box shall be fire rated when installing in fire rated walls. Refer to Architectural drawings.

## **2.09 BACK WATER VALVES**

- A. Manufacturers:
  - 1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
  - 2. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - 3. MIFAB: [www.mifab.com](http://www.mifab.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Plastic Back Water Valves (up to 4" pipe): ASME A112.14.1; PVC body and valve, extension sleeve, and access cover.

## **2.10 BACKFLOW PREVENTERS**

- A. Manufacturers:
  - 1. Apollo Valves: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
  - 2. Watts Regulator Company, a part of Watts Water Technologies: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
  - 3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Reduced Pressure Backflow Preventers:
  - 1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
  - 2. Provide with air gap fitting; pipe to adjacent floor drain receptor
  - 3. Device shall be approved for vertical installation.
- C. Double Check Valve Backflow Preventers:
  - 1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
- D. Dual Check Valve Backflow Preventers:
  - 1. ANSI/ASSE 1024 bronze body with two compact replaceable check modules with Buna "N" seals and stainless steel springs and one union with seal.
- E. Carbonated Beverage Machine Backflow Preventers:
  - 1. ASSE 1022 316 stainless steel dual check with atmospheric port designed for protection of the water supply from carbon dioxide gas and carbonated water. Atmospheric vent provides visual indication in the event the downstream check fails. Vent discharge shall be piped to an indirect waste receptor. Provide with wye pattern strainer.

## **2.11 STRAINERS**

- A. Manufacturers:
  - 1. Armstrong International, Inc: [www.armstronginternational.com](http://www.armstronginternational.com)

2. Green Country Filter Manufacturing: [www.greencountryfilter.com](http://www.greencountryfilter.com)
  3. WEAMCO: [www.weamco.com](http://www.weamco.com)
  4. Substitutions: See Section 01 6000-Product Requirements.
- B. Size 2 inches and Under:
1. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen. Lead free.
- C. Size 1-1/2 inch to 4 inches:
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen. Lead free.
- D. Size 5 inch and Larger:
1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen. Lead free.

## **2.12 WATER HAMMER ARRESTORS**

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
  2. Watts Regulator Company, a part of Watts Water Technologies: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
  3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

## **2.13 SANITARY WASTE INTERCEPTORS**

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: [www.jrsmith.com/#sle](http://www.jrsmith.com/#sle).
  2. MIFAB, Inc: [www.mifab.com/#sle](http://www.mifab.com/#sle).
  3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  4. Highland Tank: [www.highlandtank.com](http://www.highlandtank.com).
  5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Grease Interceptors - Flush-in-Floor Automatic Type
1. Application: The Grease Removal Device shall be designed for gravity separation of fats, oils, and grease along with food scraps and solids from wastewater discharged from institutional and commercial kitchens. The GRD shall be designed to remove grease automatically, collecting it neatly in an adjacent storage container from which it can be disposed and recycled with other grease by a rendering firm.
  2. Performance Requirements: Grease Removal Device shall be designed to prevent large amounts of pipe-clogging fats, oil, and grease (FOG) and solid waste materials from entering the sanitary sewer system. The GRD shall be designed to recover nearly 100% of free-floating FOG discharged from the facilities kitchen. The free fats, oil, and grease (FOG) concentration in the effluent from the GRD shall not exceed 100 mg/l (100 PPM) to satisfy sanitary sewer pretreatment requirements.
    - a. Grease Removal Device shall be a UL Listed 1D42 Waste Disposer. Provide certification documentation showing criteria under which the system was tested.
  3. General Description: Grease Removal Device shall be a Stainless Steel Flush-in-Floor GRD with fully removable and vapor-tight, stainless steel lids with gaskets and quick release stainless steel clamps, to allow access for inspection and maintenance. The GRD shall be a pre-packaged, pre-engineered, ready to install unit consisting of:
    - a. One inlet connection plain end for no hub connection to prevent inlet lines from becoming clogged with grease buildup. Inlet shall contain an internal flow control device.
    - b. A pre-settling chamber with easily removable internal stainless steel screen basket to separate and contains food scraps and solids. Screen basket shall be fully removable with stainless steel lid with quick release clamps for proper dispensing of collected solids.
    - c. A non-clogging stationary under flow baffle.
    - d. A grease separation/storage chamber containing:

- 1) Thermostatically controlled electric immersion heater(s), with 1500 watt, 115 volt, 60 HZ AC heating element, to elevate the temperature in the GRD to an average 120° F for maintaining the contained grease in a liquid state for skimming purposes.
- 2) An electrically powered, direct driven, Diskimmer(s) grease skimmer to remove fats, oil, and grease automatically from tank without any operator assistance. Diskimmer shall have oleophilic and hydrophobic, stress-relieved HDPE skimming wheel to operate at a minimum skimming rate of 20 lbs./hour. Grease is skimmed to discharge sump tube to discharge to an internal plastic 5 gallon grease container fitted with a high level alarm to alert personnel of required maintenance.
  - (a) Diskimmer shall be powered by completely enclosed, heavy-duty gear motor, 115 volt, 60 HZ AC.
- e. A multi-event digital timer/controller shall be supplied for heater(s) and Diskimmer(s) operation. Controller shall contain one (1) digital 24-hour clock timer, with multiple on/off cycles and multiple day cycles, 115 volt, 60 HZ, AC in a NEMA 3R splash-proof enclosure. Controller shall be mounted to the unit and hard wired by the installation contractor. An internal effluent downcomer at the outlet end of the GRD, to allow for discharge from the bottom of the grease separation/storage chamber only.
- f. Identification plates: Plates to be affixed in prominent location and be durable and legible throughout equipment life.
4. Unit shall come with integral solids interceptor.
5. Unit inlet invert shall be coordinated with final piping layout and unit dimensions shall be coordinated to ensure proper inlet invert is provided.

## 2.14 MIXING VALVES

### A. Thermostatic Mixing Valves:

1. Manufacturers:
  - a. Acorn: [www.acorneng.com](http://www.acorneng.com)
  - b. Leonard Valve Company: [www.leonardvalve.com/#sle](http://www.leonardvalve.com/#sle).
  - c. Powers: [www.powerscontrols.com](http://www.powerscontrols.com).
  - d. Caleffi; [www.caleffi.com/usa/en-us](http://www.caleffi.com/usa/en-us)
  - e. Substitutions: See Section 01 6000 - Product Requirements.
2. Hi-Lo Master Mixing Valve:
  - a. The Thermostatic Mixing Valve shall be IAPMO lab certified to ASSE 1017 and CSA standards and capable of meeting the control accuracy requirements of these standards at the manufacturer's listed minimum flow rates.
  - b. The valve shall contain an advanced paraffin sensor with a temperature range of 100°F to 160°F (37.8°C to 71°C) and factory set at 120°F (38°C) with a lock nut to prevent unauthorized temperature changes.
  - c. Checks and screens must be integral to the valve.
  - d. External inlet shut-offs will be included with the valve and shall be a reliable ball valve design.
  - e. Body material shall be "lead-free" brass with corrosion resistant internal components. Include outlet temperature gauge.
3. Point of Use Mixing Valve:
  - a. The Thermostatic Mixing Valve shall be IAPMO lab certified to ASSE 1069, ASSE 1070 and CSA B125.3 standards and capable of meeting the control accuracy requirements of these standards at the manufacturer's listed minimum flow rates.
  - b. Valve shall have an adjustable outlet temperature range of 90°F-115°F (32°C-46°C), factory set at 105°F (41°C).
  - c. Valve shall be a solid brass body with a capacity of 12 GPM (45 LPM) at 45 PSI (310 kPa) differential and a maximum operating pressure of 125 PSIG (862 kPa). Supply pressure variation shall be up to 20%.
  - d. Valve shall contain a copper encapsulated, paraffin-based thermal actuator.

## 2.15 PUMP CONNECTORS

### A. Manufacturers:

1. Twin City Hose: [www.twincityhose.com](http://www.twincityhose.com)
2. Metraflex: [www.metraflex.com](http://www.metraflex.com)

3. FlexHose: [www.flexhose.com](http://www.flexhose.com)
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Flexible Connectors: Braided type with wetted components or stainless steel or bronze, sized to match piping. Materials of construction shall be consistent with pipe material and equipment/pipe connection fittings. Flexible hose connectors shall be capable of compensating for lateral movement and vibrations.
- C. NSF 61 listed for potable water use.
- D. End connections: Same as specified for pipe jointing. Copper fittings shall not be attached to stainless steel hose.

## **2.16 AIR VENTS**

- A. Manufacturers:
1. Cash Acme, a brand of Reliance Worldwide Corporation: [www.cashacme.com/#sle](http://www.cashacme.com/#sle).
  2. ITT Bell & Gossett: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  3. Taco, Inc: [www.taco-hvac.com/#sle](http://www.taco-hvac.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

## **2.17 FLOOR DRAIN TRAP SEALS**

- A. Manufacturers:
1. MIFAB, Inc: [www.mifab.com/#sle](http://www.mifab.com/#sle).
  2. JR Smith: [www.jrsmith.com](http://www.jrsmith.com).
  3. Zurn: [www.zurn.com](http://www.zurn.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Push-fit EPDM or silicone fitting with a one-way membrane. For use in floor drain outlets or the adjustable strainer throats to minimize evaporation of the trap seal.
- C. Standard: Required flow rates per ASSE 1072.
- D. Size: To match floor drain in which protection device is to be installed
- E. Do not use in applications where the room/space has atmospheric pressure less than ambient pressure of the exterior of the room/space or building

## **2.18 NATURAL GAS PRESSURE REGULATORS**

- A. Manufacturers:
1. Fisher
  2. Eaton
  3. Harper Wyman Co
  4. Substitutions: See Section 01 6000-Product Requirements.
- B. Comply with ANSI Z21.18
- C. Provide with inlet and outlet pressure gage on piping.
- D. Regulator shall be capable of towndown from 10 psi ( or max pressure from Utility) to median pressure range of equipment served.
- E. Regulator to be "ventless" where installed indoors, as approved by AHJ.

## **2.19 LEAK DETECTION SYSTEMS**

- A. Manufacturers:
1. RDT Floodmaster
  2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description:
1. Leak detection system that will alarm when in contact with 1/16" of any non-flammable conductive liquid.
  2. Audible (80 dB min.) alarm.
  3. Unit shall come with dry contacts to alarm to BMS system.
  4. Systems shall be plenum rated.
  5. Systems shall consist of power supply, water sensor and receiver box. Provide additional sensors as necessary such that only one receiver is needed per location

being protected.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate clean-out locations with Architect prior to installation.
- C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- D. Encase exterior cleanouts in concrete flush with grade.
- E. Install floor cleanouts at elevation to accommodate finished floor.
- F. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- G. Pipe relief from backflow preventer to nearest drain.
- H. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to any fixture or equipment with quick closing valves..
- I. Coordinate all electrical and controls requirements of leak detection system with Division 26 an Temperature Controls Contractor.

**END OF SECTION**

**SECTION 22 3000  
PLUMBING EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Water Heaters:
  - 1. Commercial gas fired.
- B. Packaged water heating systems.
- C. Diaphragm-type compression tanks.
- D. Water softeners.
- E. In-line circulator pumps.
- F. Pressure booster systems.
- G. Elevator sump pumps.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

**1.03 REFERENCE STANDARDS**

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2019.
- B. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. UL 174 - Standard for Household Electric Storage Tank Water Heaters Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Indicate pump type, capacity, power requirements.
  - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
  - 4. Provide electrical characteristics and connection requirements.
- C. Project Record Documents: Record actual locations of components.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Pump Seals: One of each type and size.
  - 3. Extra Water Softener Salt: 50 pounds.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Certifications:
  - 1. All products in contact with potable water: NSF approved.
  - 2. Electric Water Heaters: UL listed and labeled to UL 174.
  - 3. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.
  - 4. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
  - 5. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.



- D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

#### **1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

### **PART 2 PRODUCTS**

#### **2.01 WATER HEATERS**

- A. Manufacturers:
  - 1. Lochinvar: [www.lochinvar.com/#sle](http://www.lochinvar.com/#sle).
  - 2. Aerco.
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Performance:
  - 1. The water heater shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 standard.
  - 2. The water heater's efficiency shall be verified through third party testing by AHRI and listed in the AHRI Certification Directory.
  - 3. Minimum hot water storage temperature shall be 140 degrees F, unless otherwise noted on Schedules.

#### **2.02 PACKAGED WATER HEATING SYSTEMS**

- A. System: Gas-fired direct heating boiler, circulating pump, controls, piping and valving as indicated.
- B. Boiler:
  - 1. Type: Gas-fired water tube boiler, with copper finned tube heat exchanger, steel jacket with glass fiber insulation.
  - 2. Boiler Trim: Gas burner, thermometer and pressure gauge, immersion thermostats for operating and high limit protection, 100 percent safety shut-off electric gas valve with transformer, electronic safety pilot and pilot burner, gas pressure regulator, manual gas shut-off, low water cut off, ASME rated temperature and pressure relief valve, coil relief valve, automatic boiler fill and expansion tank, draft inverter.
  - 3. Performance: Refer to Schedules.

#### **2.03 DIAPHRAGM-TYPE COMPRESSION TANKS**

- A. Manufacturers:
  - 1. Amtrol Inc: [www.amtrol.com/#sle](http://www.amtrol.com/#sle).
  - 2. Bell & Gossett, a xylem brand: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  - 3. Taco, Inc: [www.taco-hvac.com/#sle](http://www.taco-hvac.com/#sle).
  - 4. Lochinvar: [www.lochinvar.com](http://www.lochinvar.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 150 psi and 240 degrees F max working temperature, with heavy duty butyl fixed diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

#### **2.04 WATER SOFTENERS**

- A. Manufacturers:
  - 1. Culligan International Company: [www.culligan.com/#sle](http://www.culligan.com/#sle).
  - 2. Sterling Water Treatment: [www.sterlingtonwatertreatment.com/#sle](http://www.sterlingtonwatertreatment.com/#sle).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Performance: Refer to Schedules.
- C. Softener Tank:
  - 1. Epoxy lined steel tank.
  - 2. Tank supports shall be structural steel strap leg type welded to lower tank head.
- D. Exchange Resin:

1. The ion exchange resin shall be virgin high capacity "standard mesh" of sulfonated polystyrene type stable over the entire pH range with good resistance to bead fracture from attrition or osmotic shock. Each cubic foot of resin will be capable of removing 30000.0 grains of hardness as calcium carbonate when regenerated with 15.0 lbs of salt. The resin shall be solid, of the proper particle size of 16x40 mesh, U.S. standard screen and will contain no agglomerates, shells, plates or other shapes that might interfere with the normal function of the water softener. The resin shall be manufactured to comply with the food additive regulation 21 CFR 173.25 as set forth by the USFDA.
- E. Brine Tank:
1. Provide a complete brine system consisting of a plastic tank, cover, salt platform, brine well, an automatic brine valve and all necessary fittings for operation with the water softening system. The system shall consist of a combined brine measuring and salt storage tank with salt platform.
  2. The brine tank will be equipped with a float operated non-corrosive field serviceable brine float valve for automatic control of brine withdrawal and fresh water refill.
- F. Main Operating Valve:
1. The main operating valve shall be a fully automatic multiport diaphragm type. The multiport design shall incorporate all valves necessary for complete control of the softener service and regeneration steps.
  2. The diaphragm valves shall be slow opening and closing, free of water hammer. The diaphragm assembly shall be fully guided on its perimeter to assure a smooth reliable shut off without sticking. There shall be no dissimilar metals within the valve and no special tools shall be required to service the valve.
  3. The main operating valve shall be designed and manufactured by the same manufacturer as the water softener system and tested prior to shipment.
  4. The valve shall have a soft water sampling cock.
- G. Flow Control:
1. The backwash flow controller shall be a pressure-compensating orifice capable of providing and maintaining proper backwash flows over the entire listed operating pressure range of the system. The backwash flow controller shall be easily serviced without special tools and design so that service to the flow controller can be performed without disassembly of the valve body or the sequencing controller and without disconnecting existing inlet and outlet piping connections.
- H. Controls:
1. A fully integrated programmable microprocessor driven electronic controller shall be provided to automatically cycle the main operating valve through the regeneration sequence. The electronic controller shall be designed and manufactured by the same manufacturer as the water treatment equipment. Controls shall be prewired with a communication cable for BMS/BACnet communication connectivity.
  2. The controller shall include a sealed keypad, capable of programming all controller functions, located on the face of the controller. The controller display shall be a multi-line OLED display capable of full text readouts of operating status and codes.
  3. An audible alarm beeper capable of emitting a tone of ~70 dBA shall be available but capable of being disabled if so desired.
  4. The controller shall allow for a manual initiation of the automatic regeneration sequence by utilizing a regeneration selection from the controller menu.
  5. 6. The controller shall operate on a low voltage electrical system. The system shall include a UL/CUL listed transformer. The entire electronic control package and its associated inputs/outputs shall require not more than 24 VAC @ 50VA.
  6. The controller shall save pertinent programmed data and statistical functions. The controller must retain all functionality for power interruptions of less than 72 hours. A battery backup shall be installed and capable of maintaining the time of day for a minimum of 5 years.
- I. The services of a factory authorized service representative can be made available to supervise, inspect and provide operator training as required for initial start-up and system operation.

## **2.05 IN-LINE CIRCULATOR PUMPS**

- A. Manufacturers:
1. Armstrong Fluid Technology: [www.armstrongfluidtechnology.com/#sle](http://www.armstrongfluidtechnology.com/#sle).
  2. Bell & Gossett, a xylem brand: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  3. Taco: [www.tacomfort.com](http://www.tacomfort.com).
  4. Grundfos Pumps: [www.grundfos.com](http://www.grundfos.com)
  5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Small Circulator Pump:
1. The pumps shall be of the high efficiency type specifically designed for quiet operation
  2. Pump to be suitable for 203°F (95°C) operation at 150 psig (10.3 Bar) working pressure
  3. The pumps shall have a ceramic ball bearing lubricated by the system fluid.
  4. Pump body shall be lead-free (less than 0.25% Pb) brass
  5. Pump to have built-in adjustable thermostat from 68°F to 158°F (20°C to 70°C)
  6. Motor shall be spherical permanent magnet electrically commutated motor (ECM)
  7. Motor shall be non-overloading at any point on the pump curve and shall have built in overload protection
  8. Accessories:
    - a. Pre-wired 6 foot electrical plug.
    - b. Timer
- C. Large Inline Circulator with EC Motor:
1. The pumps shall be a wet rotor inline pump, lead free bronze body construction specifically designed for quiet operation. Suitable standard operations at 230° F and 175 PSIG working pressure. The pump internals shall be capable of being serviced without disturbing piping connections.
  2. The pump internals shall be capable of being serviced without disturbing piping connections.
  3. Pump shall be equipped with a water-tight seal to prevent leakage.
  4. Pump volute shall be of a cast iron design for heating systems or lead free bronze for domestic water systems. The connection style on the cast iron and bronze pumps shall be flanged.
  5. Motor shall be a synchronous, permanent-magnet (PM) motor and tested with the pump as one unit. Conventional induction motors will not be acceptable.
  6. Each motor shall have an Integrated Variable Frequency Drive tested as one unit by the manufacturer.
  7. Integrated motor protection shall be verified by UL to protect the pump against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).
  8. Pump shall have BACnet connections built into the VFD as standard options.
  9. Pumps shall be UL 778 listed and bear the UL Listed Mark for USA and Canada with on-board thermal overload protection.
  10. Pump integral controls shall allow for proportional pressure or constant temperature operating mode to vary the speed of the pump in order to maintain a differential pressure based on flow demand or constant temperature of the fluid media. Refer to schedule on plans for which operating mode is desired for this project.
    - a. Pump controls shall allow for Alternate Operation for 2 pump system such that only one pump runs at a time. The working time is switched every 24 hours.
- D. Performance: Refer to Schedules.

## **2.06 PRESSURE BOOSTER SYSTEMS**

- A. Manufacturers:
1. Armstrong Fluid Technology: [www.armstrongfluidtechnology.com/#sle](http://www.armstrongfluidtechnology.com/#sle).
  2. Bell & Gossett, a xylem brand: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  3. Syncro Flo, Inc: [www.syncroflo.com/#sle](http://www.syncroflo.com/#sle).
  4. QuantumFlo: [www.quantumflo.com](http://www.quantumflo.com).
  5. Grundfos Pumps: [www.grundfos.com](http://www.grundfos.com)
  6. Substitutions: See Section 01 6000 - Product Requirements.
- B. General Requirements:

1. All materials that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61 and the "complete system" shall be certified as constructed. Individual component certification is not compliant.
  2. Pressure ratings of pumps, pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed.
  3. The Contractor shall ascertain for himself the space and access available for the installation of a factory assembled pre-packaged and tested unit. All components of the system shall be compatible and be furnished by a single source manufacturer and all electrical services and interconnecting equipment wiring must be provided for a complete assembly with a single-source, fused power disconnect and water connections.
  4. The entire system shall be factory skid mounted on a corrosion resistant structural support frame, with in-shear molded rubber vibration isolators in compliance with standards as required in installation instructions published by pump manufacturer. Suction and Discharge Headers must be supported by pump skid frame to prevent piping strain on the pump casing and during system transport.
  5. System must meet ANSI/ASHRAE/IES 90.1, Section 10.4.2, Energy Standard for Buildings and have proof of compliance utilizing either remote sensor option or software logic which adjusts set point according to flow rate.
  6. Unions or flanges shall be provided for easy removal of pumps. System headers shall be sized for a velocity not exceeding 10 FPS at full flow and shall be terminated with a groove or flanged joint capable of accepting a groove coupling ANSI flange or groove flange furnished by Contractor.
  7. The packaged pumping system shall include all electrical wiring between components and shall be completely flow and pressure tested for actual site conditions at the factory prior to shipment.
  8. System shall be arranged such that single point connections are required for piping and electrical power supply.
  9. Individual pumps, motors and check valves shall be serviceable with the booster system in operation utilizing isolation valves for each pump.
- C. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and piping, with control panel assembled on fabricated steel base with structural steel framework.
- D. Drives: System shall feature variable frequency drives of the PWM design suitable for variable torque applications using any standard NEMA Design B squirrel cage induction motor. Variable frequency drives shall be sized for the maximum possible amp draw throughout the programmed sequence of pump operation. Drives shall be controlled via a Master/Slave control arrangement where the controller makes all adjustments via a high-speed interface which provides for greater PID resolution and PID auto-tuning. Exceptions to this requirement must be approved via pre-approval documentation with the engineer proving their energy-efficiency to the standard set forth.
- E. Controls and Instruments: Locate in NEMA 250 Type 3R, splash-proof, general purpose enclosure with main disconnect interlocked with door, fused circuit for each motor, magnetic starters with three overloads, control circuit transformer with fuse protection, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gauges.
1. Controller shall have BACnet connection capability.
  2. All system data and settings shall be accessible from the display without the need to access the high-voltage controller internals. The software shall include clear alarm indications and user wizards to ascertain and correct typically encountered system alarms.
- F. Lead Pump: Operate continuously with lag pump operating on system demand. Should lead pump fail to operate, next pump in sequence shall start automatically.
- G. Time Delay Relay: Prevent lag pump short cycling on fluctuating demands.
- H. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.
- I. Low Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.

- J. Pump Switch: Permit manual or automatic operation.
- K. Valving: Each pump outlet combination pressure reducing and check valve to maintain constant system pressure. Provide ball or butterfly valves on suction and discharge of each pump. Provide check valve on each pump discharge. Valves must be rated for maximum pressure service for the system and also comply with NSF 61 Drinking Water requirements.
- L. Pressure Sensor/Transmitter: Provide suction and discharge, stainless steel pressure sensors/transmitters which provide a 0-10 VDC signal output, compatible with the system controls, temperature and pressure requirements. The transmitter shall be installed on the system suction and discharge headers and factory wired to the control circuitry.
- M. Performance: Refer to Schedules.

## **2.07 ELEVATOR SUMP PUMPS**

- A. Electric Elevator Sump Pump
  - 1. Manufacturers:
    - a. Zoeller Company: [www.zoeller.com](http://www.zoeller.com)
    - b. Liberty Pumps: [www.libertypumps.com](http://www.libertypumps.com)
    - c. Bell and Gossett: [www.bellgossett.com](http://www.bellgossett.com)
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Type: Completely submersible, vertical, centrifugal.
  - 3. Casing: Cast iron pump body .
  - 4. Impeller: Engineered thermoplastic or cast iron; open non-clog, steel shaft.
  - 5. Bearings: Sleeve bearing - Upper, Ball bearings - Lower.
  - 6. Accessories:
    - a. UL Listed power chord.
    - b. Piggyback variable level switch.
    - c. Full flow check valve and gate valve to be field mounted in discharge piping.
  - 7. Controls: UL Listed, separate control panel with alarm switch, automatic alarm reset, horn silence switch and alarm test switch. Horn shall be rated for 85 dB at 10 feet. Pre-mounted terminal block with connections for pump and float switch.
  - 8. Sump: By Architectural Trades with grated cover. Coordinate with GC. Min. size shall be 24"x24"x30" or as required by pump manufacturer.
- B. Single Hydraulic Elevator Sump Pump & Oil Detection System
  - 1. Manufacturers:
    - a. Liberty Pumps: [www.libertypumps.com](http://www.libertypumps.com)
    - b. Or Other State Approved Provider
  - 2. Type: Completely submersible with oil detecting controls
  - 3. Casing: Cast iron pump body with oil filled motor housing.
  - 4. Shaft: Stainless steel
  - 5. Hardware: Stainless steel
  - 6. Bearings: Ball bearings - Upper and Lower.
  - 7. Impeller: Engineered thermoplastic
  - 8. Accessories:
    - a. UL listed power chord.
    - b. Full flow check valve and gate valve to be field mounted in discharge piping.
  - 9. Controls: ASME A17.1 compliant, separate control panel with separate pump and control circuits. Remote alarm with auxiliary contacts for connection to BMS. The control unit has three probes and a float ball switch. The pump will activate when the middle probe contacts water and will remain on until the first, longest probe is no longer in contact with water. A high water alarm is activated when the third probe contacts water. The system will ignore a small film of oil, however larger volumes of oil will be detected when the alarm probe does not detect water and the float ball activates. The system will continue to operate, removing water, not oil, from the sump even when oil had been detected.
    - a. Power on, Pump Run, High Water and High oil lights.
  - 10. Sump: By Architectural Trades with grated cover. Coordinate with GC. Min. size shall be 24"x24"x30" or as required by pump manufacturer.

## **2.08 ELECTRICAL WORK**

- A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.
- B. Electrical characteristics to be as specified or indicated.
- C. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related gas venting and electrical work to achieve operating system.
- C. Provide for the service of a competent factory-trained supervising agent from the equipment manufacturer to inspect the completed installation, start the system and acquaint the operators with the proper operation and maintenance of the equipment.
- D. Pumps:
  - 1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve, balancing valve and isolating valve on discharge.
  - 2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
  - 3. Reduction from line size to pump connection size shall be made with eccentric reducers attached to the pump with tops flat to allow continuity of flow and to avoid air pockets.
  - 4. Provide temperature and pressure gauges where and as detailed or directed.
  - 5. All piping shall be brought to equipment and pump connections in such a manner so as to prevent the possibility of any load or stress being applied to the connections or piping.
  - 6. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instruction and per applicable state, federal, and local codes.
  - 7. Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the control's contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal, and local codes.
  - 8. Power and control wiring shall run in separate channel.
  - 9. Pumps that are supplied with an integrated VFD and should not be used with any external VFDs.
  - 10. Pumps shall NOT be run dry to check rotation.
- E. Floor Mounted Equipment:
  - 1. Install the system level and in accordance with manufacturer's published recommendations.
  - 2. Locate equipment with allowance for manufacturer's recommended clearances around unit.
  - 3. Set entire unit on 4" high reinforced concrete equipment pad.
  - 4. Pipe discharge from all relief valves, drains and individual pump thermal purge protection solenoid valves, indirectly to floor drain having adequate capacity to accept discharge.
- F. Booster Pumps: Provide, Type "L" copper branch feed to the bladder tank (if required) with isolation valve from system distribution main as shown on the Contract Drawings.

### **END OF SECTION**

## **SECTION 22 4000 PLUMBING FIXTURES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Service sinks.
- F. Electric water coolers.
- G. Bathtubs.
- H. Showers.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Owner-furnished fixtures.
- B. Section 22 1005 - Plumbing Piping.
- C. Section 22 1006 - Plumbing Piping Specialties.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration. 2013.
- C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
- D. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- E. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures 2018.
- F. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018.
- G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2017.
- H. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2017.
- I. NSF 61 - Drinking Water System Components - Health Effects 2020.
- J. NSF 372 - Drinking Water System Components - Lead Content 2020.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Faucet Washers: Two sets of each type and size.
  - 3. Extra Toilet Seats: One of each type and size.
  - 4. Flush Valve Service Kits: One for each type and size.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

#### **1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

- B. Provide five year manufacturer warranty for electric water cooler.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

### **2.02 REGULATORY REQUIREMENTS**

- A. Comply with applicable codes for installation of plumbing systems.
- B. Perform work in accordance with local health department regulations.

### **2.03 FLUSH VALVE WATER CLOSETS**

- A. Water Closets: Vitreous china, ASME A112.19.2, wall hung or floor mounted as indicated on Schedules, siphon jet flush action, china bolt caps.
  - 1. Flush Valve: Exposed (top spud).
  - 2. Flush Operation: Refer to Schedules.
  - 3. Manufacturers:
    - a. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
    - b. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
    - c. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
    - d. Sloan: [www.sloan.com](http://www.sloan.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Flush Valves: ASME A112.18.1, diaphragm type , complete with dual filtered by-pass, vacuum breaker stops and accessories.
  - 1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
  - 2. Manufacturers:
    - a. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
    - b. Sloan Valve Company: [www.sloanvalve.com/#sle](http://www.sloanvalve.com/#sle).
    - c. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
    - d. Kohler Company[<>]: [www.kohler.com/#sle](http://www.kohler.com/#sle).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Seats:
  - 1. Manufacturers:
    - a. Bemis Manufacturing Company: [www.bemismfg.com/#sle](http://www.bemismfg.com/#sle).
    - b. Church Seat Company: [www.churchseats.com/#sle](http://www.churchseats.com/#sle).
    - c. Centoco: [www.centoco.com](http://www.centoco.com)
    - d. Manufacturer of Closet Bowl.
    - e. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.
- D. Water Closet Carriers For Wall Hung Closets:
  - 1. Manufacturers:
    - a. Jay R. Smith MFG. Co: [www.jrsmith.com/#sle](http://www.jrsmith.com/#sle).
    - b. JOSAM Company: [www.josam.com/#sle](http://www.josam.com/#sle).
    - c. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

### **2.04 TANK TYPE WATER CLOSETS**

- A. Tank Type Water Closet Manufacturers:
  - 1. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
  - 3. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Bowl: ASME A112.19.2; wall or floor mounted as indicated in Schedules, siphon jet, vitreous china, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps.



- C. Seat Manufacturers:
  - 1. Bemis Manufacturing Company: [www.bemismfg.com/#sle](http://www.bemismfg.com/#sle).
  - 2. Church Seat Company: [www.churchseats.com/#sle](http://www.churchseats.com/#sle).
  - 3. Centoco: [www.centoco.com](http://www.centoco.com)
  - 4. Manufacturer of Closet Bowl.
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- D. Seat: Solid white plastic, open front, brass bolts, without cover, complete with self-sustaining hinge.

## 2.05 WALL HUNG URINALS

- A. Wall Hung Urinal Manufacturers:
  - 1. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
  - 3. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - 4. Sloan: [www.sloan.com](http://www.sloan.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
  - 1. Flush Valve: Exposed (top spud).
  - 2. Flush Operation: Refer to Schedules.
  - 3. Trap: Integral.
- C. Flush Valves: ASME A112.18.1, diaphragm type , complete with dual filtered by-pass, vacuum breaker stops and accessories.
  - 1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
  - 2. Manufacturers:
    - a. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
    - b. Sloan Valve Company: [www.sloanvalve.com/#sle](http://www.sloanvalve.com/#sle).
    - c. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
    - d. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- D. Carriers:
  - 1. Manufacturers:
    - a. Jay R. Smith MFG. Co: [www.jrsmith.com/#sle](http://www.jrsmith.com/#sle).
    - b. JOSAM Company: [www.josam.com/#sle](http://www.josam.com/#sle).
    - c. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

## 2.06 LAVATORIES

- A. Lavatory Manufacturers:
  - 1. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
  - 3. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - 4. Sloan: [www.sloan.com](http://www.sloan.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Vitreous China Basin: ASME A112.19.2; vitreous china wall hung or counter-top mounted as indicated on Schedules, with overflow.
- C. Supply Faucet Manufacturers:
  - 1. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
  - 3. Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - 4. Symmons: [www.symmons.com](http://www.symmons.com).
  - 5. Delta Faucet: [www.deltafaucet.com](http://www.deltafaucet.com)
  - 6. Sloan: [www.sloan.com](http://www.sloan.com)
  - 7. Substitutions: See Section 01 6000 - Product Requirements.

- D. Supply Faucet: ASME A112.18.1; chrome plated supply fitting with water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), ADA compliant handles.
- E. Accessories:
  - 1. Lavatory P-trap shall be chrome plated cast brass adjustable ground joint swivel with cleanout, with 17- gauge seamless brass adjustable wall bend provided with deep bell flange. P-Trap to have 2" water seal and rough-in complete, adapter extensions are not allowed. P-Trap shall be certified by CSA or other recognized third-party testing authority and marked with manufacturer's name. No private label wholesale products will be allowed.
  - 2. Offset waste with perforated open strainer.
  - 3. Screwdriver Loose key stops.
  - 4. Lavatory supply kits shall include chrome plated all brass stops with brass stems, no plastic stems. Kits shall have 12" chrome plated copper risers and shallow brass flange. Inlet shall be 1/2" compression and outlet shall be 3/8" compression. Supply kit shall be certified by recognized independent third-party testing authority, will be marked with the manufacturer's name and comply with the SDWA (Safe Drinking Water Act) "No Lead" restrictions of ANSI NSF 61, Sec. 9. No private label wholesale products will be allowed.
  - 5. All exposed lavatory and sink trim on wheelchair accessible fixtures shall be covered with a seamless antimicrobial vinyl insulating outer shell. Material shall be flame retardant and fungal and bacterial resistant. Insulating kits shall include covers for, drain tailpiece, all P-Trap components, and hot/cold water supplies.
  - 6. Install with point of use thermostatic mixing valve. Refer to Section 22 1006.
  - 7. Carrier for Wall Mounted Lavatories:
    - a. Manufacturers:
      - 1) Jay R. Smith MFG. Co: [www.jrsmith.com/#sle](http://www.jrsmith.com/#sle).
      - 2) JOSAM Company: [www.josam.com/#sle](http://www.josam.com/#sle).
      - 3) Zurn Industries, Inc: [www.zurn.com/#sle](http://www.zurn.com/#sle).
      - 4) Substitutions: See Section 01 6000 - Product Requirements.
    - b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

## 2.07 SINKS

- A. Sink Manufacturers:
  - 1. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Elkay: [www.elkay.com](http://www.elkay.com).
  - 3. Just Manufacturing: [www.justmfg.com](http://www.justmfg.com)
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. General: ASME A112.19.3, stainless steel, self rimming and undercoated.
- C. Bowl Quantity and Size: Refer to Schedules.
- D. Faucet:
  - 1. Gooseneck faucet with ADA wristblade handles
  - 2. Flowrate: Refer to Schedules.
  - 3. Manufacturers:
    - a. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
    - b. Chicago Faucet: [www.chicagofaucets.com](http://www.chicagofaucets.com)
    - c. Delta Faucet: [www.deltafaucet.com](http://www.deltafaucet.com)
    - d. Substitutions: See Section 01 6000-Product Requirements.
- E. Accessories:
  - 1. Garbage Disposal:
    - a. Provide garbage disposal for sink. For multiple bowl sinks, coordinate which drain to install disposal in with Architect.
    - b. Disposal shall have stainless steel grind chamber, continuous feed, automatic reversing action with 120V, single phase motor. Refer to Schedules for motor HP.
    - c. Manufacturers:
      - 1) In-Sink-Erator
      - 2) Substitutions: See Section 01 6000-Product Requirements.
  - 2. Drain:

- a. Removable basket strainer.
- 3. Sink P-trap shall be chrome plated cast brass adjustable ground joint swivel with cleanout, with 17- gauge seamless brass adjustable wall bend provided with deep bell flange. P-Trap to have 2" water seal and rough-in complete, adapter extensions are not allowed. P-Trap shall be certified by CSA or other recognized third-party testing authority and marked with manufacturer's name. No private label wholesale products will be allowed.
- 4. Screwdriver, Loose key stops.
- 5. Lavatory supply kits shall include chrome plated all brass stops with brass stems, no plastic stems. Kits shall have 12" chrome plated copper risers and shallow brass flange. Inlet shall be 1/2" compression and outlet shall be 3/8" compression. Supply kit shall be certified by recognized independent third-party testing authority, will be marked with the manufacturer's name and comply with the SDWA (Safe Drinking Water Act) "No Lead" restrictions of ANSI NSF 61, Sec. 9. No private label wholesale products will be allowed.
- 6. All exposed lavatory and sink trim on wheelchair accessible fixtures shall be covered with a seamless antimicrobial vinyl insulating outer shell. Material shall be flame retardant and fungal and bacterial resistant. Insulating kits shall include covers for, drain tailpiece, all P-Trap components, and hot/cold water supplies.
- 7. Install with point of use thermostatic mixing valve, where noted in Schedules or where fixture must be ADA compliant. Refer to Section 22 1006.

## **2.08 BATHTUBS AND SHOWERS**

- A. Bathtub/Shower Manufacturers:
  - 1. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Kohler Company: [www.kohler.com/#sle](http://www.kohler.com/#sle).
  - 3. Sterling: [www.sterlingplumbing.com](http://www.sterlingplumbing.com)
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Bathtub/Shower: Refer to Schedules.
- C. Bath and Shower Trim: ASME A112.18.1; ASSE 1016; concealed shower and over rim supply with diverter spout, pressure balanced mixing valve, bent shower arm with adjustable spray ball joint showerhead with maximum flow rate as listed in Schedules and escutcheon, lever operated pop-up waste and overflow.

## **2.09 BI-LEVEL, ELECTRIC WATER COOLERS**

- A. Bi-level, Electric Water Cooler Manufacturers:
  - 1. Elkay Manufacturing Company: [www.elkay.com/#sle](http://www.elkay.com/#sle).
  - 2. Haws Corporation: [www.hawesco.com/#sle](http://www.hawesco.com/#sle).
  - 3. Murdock Manufacturing, Inc: [www.murdockmfg.com/#sle](http://www.murdockmfg.com/#sle).
  - 4. Oasis International: [www.oasiscoolers.com/#sle](http://www.oasiscoolers.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Water Cooler: Bi-level, electric, mechanically refrigerated; mounting as specified on Schedules, ADA compliant; elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser.
  - 1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
  - 2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.
- C. Bottle Filler: Materials to match fountain.

## **2.10 SERVICE SINKS**

- A. Service Sink Manufacturers:
  - 1. American Standard, Inc: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Elkay Manufacturing Company: [www.elkay.com/#sle](http://www.elkay.com/#sle).
  - 3. Just Manufacturing Company: [www.justmfg.com/#sle](http://www.justmfg.com/#sle).
  - 4. Fiat: [www.fiatproducts.com](http://www.fiatproducts.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Bowl: ASME A112.19.1; porcelain enamelled (inside only) cast iron roll-rim sink or white molded stone, with 12 inch high back, concealed hanger, chrome plated strainer, stainless

steel rim or vinyl bumper guards.

- C. Trim: ASME A112.18.1 exposed wall type supply, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- D. Accessories:
  - 1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
  - 2. Hose clamp hanger.
  - 3. Mop hanger.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.
- D. Examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.
- E. Inspect fixtures and accessories that are to be removed and relocated. Damaged or blemished items shall be brought to Architect's/Engineer's attention before reinstalling.

### **3.02 PREPARATION**

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

### **3.03 INSTALLATION**

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Install components level and plumb.
- C. Piping exposed to view shall be chrome plated.
- D. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

### **3.04 INTERFACE WITH WORK OF OTHER SECTIONS**

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- B. Adjust or replace washers to prevent leaks at faucets and stops.

### **3.05 ADJUSTING**

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

### **3.06 CLEANING**

- A. Clean plumbing fixtures and equipment.

### **3.07 PROTECTION**

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

### **3.08 FEILD QUALITY CONTROL**

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new

units.

**END OF SECTION**

**SECTION 23 0005  
BASIC HVAC REQUIREMENTS**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. This section applies to all sections of Division 23.
- B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.
- C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

**1.02 APPLICATION**

- A. This section applies to all mechanical work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.
- B. The mechanical contractor is responsible for the installation and operation of the hvac systems and temperature control systems.
- C. The mechanical contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

**1.03 INSPECTION OF SITE**

- A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

**1.04 ALTERNATES AND SUBSTITUTIONS**

- A. Refer to Division 01 - General Requirements for procedures.

**1.05 DEVIATION FROM BASIS OF DESIGN MANUFACTURER**

- A. Products identified within the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should the Division 23 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

**1.06 MATERIALS**

- A. Mechanical equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.
- B. The Mechanical Trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22, and 23 of these specifications, including all wiring devices, conduit, etc.
- C. Power wiring 120 volts and greater shall be by the Electrical Trades.

**1.07 DRAWINGS**

- A. The drawings are diagrammatic and show the general location and arrangement of all equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.

- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. The mechanical and electrical contractor shall check all documents including architectural, structural, plumbing, HVAC and electrical to avert possible installation conflicts. Arrange work accordingly, providing such fittings, traps, valves and accessories as may be required to meet such conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Do not scale drawings for measurements.
- F. Field verifications of actual existing conditions are required by the contractor since actual locations, distances, and levels will be governed by actual field conditions. All measurements shall be verified at the site.
- G. If during field verification, the contractor identifies that there may require substantial changes from the original plans, the contractor shall notify the architect for agreement on necessary adjustment before the installation is started
- H. Discrepancies shown between plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.
- I. Drawings and specifications are intended to cover the completed installation of systems to function as described. The omission of the expressed reference to any item of labor and material necessary to comply with practice codes, ordinances, etc., shall not relieve the contractor from providing such additional labor and material at no cost to Owner.

#### **1.08 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 23 shall be the latest issue, unless otherwise noted.
- B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

#### **1.09 MAINTENANCE**

- A. Provide 40 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.
- B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for owner and shall be bound in book or ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

#### **1.10 WARRANTY AND GUARANTEE**

- A. Contractor shall guarantee all work installed by themselves or their subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or

equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications.

Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

### **1.11 SUBMITTALS**

- A. Refer to Division 01 - General Requirements for procedures.
- B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (hvac equipment, piping equipment, etc.). Refer to other sections of the mechanical specifications for additional requirements.
- C. Engineer WILL NOT REVIEW:
  - 1. Submittals not specified.
  - 2. Submittals not reviewed by Contractor, including Contractor stamp with signature comments.
  - 3. Submittals made after work is delivered to site and/or installed.
  - 4. Submittal resubmissions unless resubmission is required by Architect/Engineer.
- D. Types of submittals include the following:
  - 1. Shop Drawings
  - 2. Product Data Sheets
  - 3. Samples
  - 4. Manufacturers Instructions
  - 5. Maintenance Data
  - 6. Warranty
- E. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.
- F. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from mistakes in submittals.

### **1.12 RECORD DRAWINGS**

- A. Refer to Division 01 - General Requirements for procedures.
- B. Contractor shall provide the following record drawings as part of the Project closeout document process:
  - 1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
  - 2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.
- C. Record drawings shall be maintained by the contractor up to date as the project progresses.
- D. Recording all deviations from the contract documents, indicate exact locations of all buried services both inside and outside of the building; include concealed piping and equipment in the entire contract. Final record drawings shall reflect the as-built conditions.

### **1.13 QUALITY ASSURANCE**

- A. Other referenced standards:
  - 1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE

## **PART 2 PRODUCTS**

### **2.01 SLEEVES AND ESCUTCHEONS**

- A. Provide sleeves wherever pipes pass through exterior wall, and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast



brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleeves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit within the sleeve shall be sealed at each installation with a 3M approved sealant.

## **2.02 DIELECTRIC UNIONS**

- A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

## **2.03 FILTERS**

- A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment without all prefilters and final filters as specified. Immediately prior to final building acceptance by the owner, contractor shall replace all disposable type air filters with new.

## **2.04 BUILDING ATTACHMENTS FOR MECHANICAL WORK SUPPORTS**

- A. General Requirements:
  - 1. Provide building attachments required for supporting mechanical work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
  - 2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
  - 3. If specially designed building attachments are required, retain the services of a licensed structural engineer to design such building attachments.
  - 4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
  - 5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.
- B. Attachments to Structural Steel:
  - 1. Support mechanical work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
    - a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
    - b. Side beam clamp with retaining clips - for loads up to 120 lb.
- C. Cast in Place Concrete Inserts:
  - 1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#
- D. Drilled Insert Anchors:
  - 1. Where mechanical work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.
  - 2. Manufacturers: Hilti

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Existing piping and ductwork: when encountered during the course of work, protect, brace and support existing piping and ductwork where required for proper execution of the work.
- B. Interruption of existing active piping and ductwork: when the course of work makes shut-down of services unavoidable, the mechanical contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference

with established operating routine.

- C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderly fashion.
- D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

### **3.02 ACCESSIBILITY**

- A. Do not locate valves, traps, controls, unions, dampers, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in mechanical, electrical, and plumbing systems.

### **3.03 ACCESS DOORS AND PANELS**

- A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.
- B. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.
- C. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials Manufacturer: Milcor, Bilco.

### **3.04 CUTTING AND PATCHING**

- A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.
- B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.
- C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

### **3.05 ROUGH-IN FOR CONNECTION TO EQUIPMENT**

- A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

### **3.06 MATERIAL AND EQUIPMENT**

- A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

### **3.07 SEAL PENETRATIONS**

- A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

### **3.08 SOUND CONTROL**

- A. Penetrations shall be maintained airtight to prevent sound transfer.
- B. Piping, ductwork, etc. shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

### **3.09 FIRESTOPPING**

- A. Refer to Division 07 - Thermal and Moisture Protection for more information.
- B. Provide UL classified firestopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

### **3.10 DELIVERY, STORAGE AND HANDLING OF EQUIPMENT AND MATERIALS**

- A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.
- B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.
- C. Contractor shall provide temporary protection for installed equipment prior to project completion.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.
- F. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- G. Protect dampers, grilles, louvers from damage to operating linkages and blades.

### **3.11 CLEANING**

- A. Refer to Division 01 - General Requirements; all mechanical equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

### **3.12 CONTROL WIRING**

- A. All control wiring for mechanical and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

**END OF SECTION**

**SECTION 23 0553  
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

**1.02 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.

**PART 2 PRODUCTS**

**2.01 NAMEPLATES**

- A. Manufacturers:
  - 1. Seton Identification Products, a Tricor Direct Company: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 2. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
  - 3. Champion America, Inc: [www.champion-america.com](http://www.champion-america.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Letter Color: White.
- C. Letter Height: 1/4 inch.
- D. Background Color: Black.

**2.02 TAGS**

- A. Manufacturers:
  - 1. Seton Identification Products, a Tricor Company: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 2. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
  - 3. Champion America, Inc: [www.champion-america.com](http://www.champion-america.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

**2.03 PIPE MARKERS**

- A. Manufacturers:
  - 1. Seton Identification Products, a Tricor Company: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 2. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
  - 3. Champion America, Inc: [www.champion-america.com](http://www.champion-america.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Color: Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### **3.02 INSTALLATION**

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with nameplates. Small devices, such as inline pumps, may be identified with tags.
- F. Identify control panels and major control components outside panels with nameplates.
- G. Identify thermostats relating to terminal boxes or valves with nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units and radiator valves with numbered tags.
- J. Identify piping, concealed or exposed, with pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

**END OF SECTION**

**SECTION 23 0593**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 0005 - Basic HVAC Requirements.

**1.03 REFERENCE STANDARDS**

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008 (Reaffirmed 2017).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
  - 1. Submit six weeks prior to starting the testing, adjusting, and balancing work.
  - 2. Include at least the following in the plan:
    - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    - d. Final test report forms to be used.
    - e. Details of how TOTAL flow will be determined; for example:
      - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
      - 2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
    - f. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
    - g. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Owner and Engineer and for inclusion in operating and maintenance manuals.
  - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
  - 6. Include the following on the title page of each report:
    - a. Name of Testing, Adjusting, and Balancing Agency.

- b. Address of Testing, Adjusting, and Balancing Agency.
  - c. Telephone number of Testing, Adjusting, and Balancing Agency.
  - d. Project name.
  - e. Project location.
  - f. Report date.
- E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
  - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  - 3. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  - 2. Certified by one of the following:
    - a. AABC, Associated Air Balance Council: [www.aabc.com/#sle](http://www.aabc.com/#sle); upon completion submit AABC National Performance Guaranty.
    - b. NEBB, National Environmental Balancing Bureau: [www.nebb.org/#sle](http://www.nebb.org/#sle).
    - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: [www.tabbcertified.org/#sle](http://www.tabbcertified.org/#sle).
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
- F. Approved TAB Agencies:
  - 1. Baromatic.
  - 2. Enviroaire.
  - 3. Controls Solutions Inc. (CSI).
  - 4. Environmental Testing Services.
  - 5. Substitutions must be approved by Engineer during Bid Phase.

### **3.02 EXAMINATION**

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - 5. Duct systems are clean of debris.
  - 6. Fans are rotating correctly.
  - 7. Fire and volume dampers are in place and open.
  - 8. Air coil fins are cleaned and combed.
  - 9. Access doors are closed and duct end caps are in place.
  - 10. Air outlets are installed and connected.
  - 11. Duct system leakage is minimized.
  - 12. Hydronic systems are flushed, filled, and vented.
  - 13. Pumps are rotating correctly.
  - 14. Proper strainer baskets are clean and in place.

15. Service and balance valves are open.

B. Beginning of work means acceptance of existing conditions.

### **3.03 ADJUSTMENT TOLERANCES**

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

### **3.04 RECORDING AND ADJUSTING**

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

### **3.05 AIR SYSTEM PROCEDURE**

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

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.

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 extend 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. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For fans with variable pitch sheaves: Sheaves in equipment provided by manufacturer are for final belt and sheave sizing ONLY. TAB contractor shall be responsible for providing and installing final sheave and belt for fan.

### **3.06 SCOPE**

A. Test, adjust, and balance the following:

1. Plumbing Pumps.
2. Boilers.
3. Forced Air Furnaces.



4. Packaged Roof Top Heating/Cooling Units.
5. Terminal Heat Transfer Units.
6. Fans.
7. Air Terminal Units.
8. Air Inlets and Outlets.

### **3.07 MINIMUM DATA TO BE REPORTED**

- A. Electric Motors:
  1. Manufacturer.
  2. Model/Frame.
  3. HP/BHP.
  4. Phase, voltage, amperage; nameplate, actual, no load.
  5. RPM.
  6. Service factor.
  7. Starter size, rating, heater elements.
  8. Sheave Make/Size/Bore.
- B. V-Belt Drives:
  1. Identification/location.
  2. Required driven RPM.
  3. Driven sheave, diameter and RPM.
  4. Belt, size and quantity.
  5. Motor sheave diameter and RPM.
  6. Center to center distance, maximum, minimum, and actual.
- C. Pumps:
  1. Identification/number.
  2. Manufacturer.
  3. Size/model.
  4. Impeller.
  5. Service.
  6. Design flow rate, pressure drop, BHP.
  7. Actual flow rate, pressure drop, BHP.
  8. Discharge pressure.
  9. Suction pressure.
  10. Total operating head pressure.
  11. Shut off, discharge and suction pressures.
  12. Shut off, total head pressure.
- D. Combustion Equipment:
  1. Boiler manufacturer.
  2. Model number.
  3. Serial number.
  4. Firing rate.
  5. Burner manifold gas pressure.
  6. Ambient temperature.
  7. Heat output.
- E. Electric Duct Heaters:
  1. Manufacturer.
  2. Identification/number.
  3. Location.
  4. Model number.
  5. Design kW.
  6. Number of stages.
  7. Phase, voltage, amperage.
  8. Test voltage (each phase).
  9. Test amperage (each phase).
  10. Air flow, specified and actual.
  11. Temperature rise, specified and actual.
- F. Air Moving Equipment:

1. Location.
  2. Manufacturer.
  3. Model number.
  4. Serial number.
  5. Arrangement/Class/Discharge.
  6. Air flow, specified and actual.
  7. Return air flow, specified and actual.
  8. Outside air flow, specified and actual.
  9. Total static pressure (total external), specified and actual.
  10. Inlet pressure.
  11. Discharge pressure.
  12. Sheave Make/Size/Bore.
  13. Number of Belts/Make/Size.
  14. Fan RPM.
- G. Exhaust Fans:
1. Location.
  2. Manufacturer.
  3. Model number.
  4. Serial number.
  5. Air flow, specified and actual.
  6. Total static pressure (total external), specified and actual.
  7. Inlet pressure.
  8. Discharge pressure.
  9. Sheave Make/Size/Bore.
  10. Number of Belts/Make/Size.
  11. Fan RPM.
- H. Duct Traverses:
1. System zone/branch.
  2. Duct size.
  3. Area.
  4. Design velocity.
  5. Design air flow.
  6. Test velocity.
  7. Test air flow.
  8. Duct static pressure.
  9. Air temperature.

**END OF SECTION**

## **SECTION 23 0713 DUCT INSULATION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Duct insulation.
- B. Duct liner.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 23 0005 - Basic HVAC Requirements.
- B. Section 23 3100 - HVAC Ducts and Casings: Glass fiber ducts.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.
- F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

#### **1.05 QUALITY ASSURANCE**

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

### **PART 2 PRODUCTS**

#### **2.01 REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

#### **2.02 GLASS FIBER, FLEXIBLE**

- A. Manufacturer:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 3. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
  - 4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).

5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
  1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
  2. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
  1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
  1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

## **2.03 GLASS FIBER, RIGID**

- A. Manufacturer:
  1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  2. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  3. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
  4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
  1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
  2. Maximum Service Temperature: 450 degrees F.
  3. Maximum Water Vapor Absorption: 5.0 percent.
- C. Vapor Barrier Jacket:
  1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
  3. Secure with two coats of vapor barrier mastic and glass tape.
- D. Vapor Barrier Tape:
  1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

## **2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

- A. Manufacturers:
  1. Aeroflex USA, Inc: [www.aeroflexusa.com/#sle](http://www.aeroflexusa.com/#sle).
  2. Armacell LLC: [www.armacell.us/#sle](http://www.armacell.us/#sle).
  3. K-Flex USA LLC: [www.kflexusa.com/#sle](http://www.kflexusa.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
  1. Minimum Service Temperature: Minus 40 degrees F.
  2. Maximum Service Temperature: 180 degrees F.
  3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

## **2.05 DUCT LINER**

- A. Manufacturers:
  1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  2. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  3. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
  4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Note: Choose the liner type - Elastomeric Foam or Glass Fiber.

- C. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
  - 1. Minimum Service Temperature: Minus 40 degrees F.
  - 2. Maximum Service Temperature: 180 degrees F.
  - 3. Connection: Waterproof vapor barrier adhesive.
- D. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer.
  - 1. Fungal Resistance: No growth when tested according to ASTM G21.
  - 2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
  - 3. Service Temperature: Up to 250 degrees F.
  - 4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
  - 5. Minimum Noise Reduction Coefficients:
    - a. 1 inch Thickness: 0.45.
- E. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- F. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- E. Slope exterior ductwork to shed water.
- F. External Duct Insulation Application:
  - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
  - 2. Secure insulation without vapor barrier with staples, tape, or wires.
  - 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
  - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
  - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
  - 1. Adhere insulation with adhesive for 90 percent coverage.
  - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
  - 3. Seal and smooth joints. Seal and coat transverse joints.
  - 4. Seal liner surface penetrations with adhesive.
  - 5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

#### **3.03 SCHEDULES**

- A. Exhaust and Relief Ducts Within 10 ft of Exterior Openings:
  - 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
- B. Outside Air Intake Ducts:
  - 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.

- C. Plenums:
  - 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
  - 2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.
- D. Return Air Ducts:
  - 1. Duct Liner: 1 inch thick. First 10 feet from equipment only.
- E. Supply Ducts:
  - 1. Duct Liner: 1 inch thick. First 10 feet from equipment only.
  - 2. Located in plenum or unconditioned space:
    - a. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
  - 3. Located exposed in conditioned space:
    - a. No insulation required.
- F. Transfer Ducts:
  - 1. Duct Liner: 1 inch thick. First 10 feet from equipment only.
- G. Ducts Exposed to Outdoors:
  - 1. Flexible Elastomeric Duct Insulation: 2 inches thick
  - 2. Cover finished insulation with field applied a glass cloth jacket embedded in Foster No. 60-60 fire resistive mastic.

**END OF SECTION**

**SECTION 23 0913  
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Control panels.
- B. Dampers.
- C. Damper Operators:
  - 1. Electric operators.
- D. Input/Output Sensors:
  - 1. Temperature sensors.
  - 2. Humidity sensors.
  - 3. Static pressure (air pressure) sensors.
  - 4. Equipment operation (current) sensors.
  - 5. Carbon monoxide sensors.
  - 6. Carbon dioxide sensors.
- E. Thermostats:
  - 1. Low-limit temperature cutout switch (freezestat)
  - 2. Room thermostat accessories.
  - 3. Airstream thermostats.
- F. Transmitters:
  - 1. Pressure transmitters.
  - 2. Air pressure transmitters.
  - 3. Temperature transmitters.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 0519 - Meters and Gauges for HVAC Piping: Thermometer sockets and gauge taps.
- B. Section 23 0923 - Direct-Digital Control System for HVAC.
- C. Section 23 2113 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.
- D. Section 23 2114 - Hydronic Specialties.
- E. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.
- F. Section 26 2726 - Wiring Devices: Elevation of exposed components.

**1.03 REFERENCE STANDARDS**

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Manufacturer's Instructions: Provide for all manufactured components.
- E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- F. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
  - 1. Revise shop drawings to reflect actual installation and operating sequences.

## **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## **1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT - GENERAL**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

### **2.02 CONTROL PANELS**

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- B. NEMA 250, general purpose utility enclosures with enameled finished face panel.
- C. Provide common keying for all panels.

### **2.03 DAMPERS**

- A. Performance Requirements:
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.
  - 3. Delegated Design: Engage a qualified professional, as defined in Section 014000 "Quality Requirements," to size products where indicated as delegated design.
  - 4. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.
  - 5. Backup Power Source: Systems and equipment served by a backup power source shall have associated control damper actuators served from a backup power source.
  - 6. Environmental Conditions:
  - 7. Provide electric control-damper actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated.
  - 8. Electric control-damper actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.
  - 9. Hazardous Locations: Explosion-proof rating for condition.
  - 10. Selection Criteria:
    - a. Fail positions unless otherwise indicated:
      - 1) Supply Air: Last position.
      - 2) Return Air: Last position.
      - 3) Outdoor Air: Last position.
      - 4) Mixed Air: Last position.
      - 5) Exhaust Air: Last position.
    - b. Dampers shall have stable operation throughout full range of operation, from design to minimum airflow over varying pressures and temperatures encountered.
    - c. Select modulating dampers for a pressure drop of 2 percent of fan total static pressure unless otherwise indicated.
    - d. Two-position dampers shall be full size of duct or equipment connection unless otherwise indicated.
    - e. Pneumatic, two-position control dampers shall provide a smooth opening and closing characteristic slow enough to avoid excessive pressure. Dampers with pneumatic actuators shall have an adjustable opening time (valve full closed to full open) and an adjustable closing time (valve full open to full closed) ranging from zero to 10 seconds. Opening and closing times shall be independently adjustable.



- f. Control-damper, pneumatic-control signal shall not exceed 200 feet. For longer distances, provide an electric/electronic control signal to the damper and an electric solenoid valve or electro-pneumatic transducer at the damper to convert the control signal to pneumatic.
  - 11. Unless otherwise indicated, use parallel blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed blade configuration.
  - 12. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.
  - 13. Damper actuator shall be factory installed by damper manufacturer as integral part of damper assembly. Coordinate actuator location and mounting requirements with damper manufacturer.
- B. Manufacturers:
- 1. Ruskin.
  - 2. Greenheck.
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Performance: Test in accordance with AMCA 500-D.
- D. Frames: Extruded aluminum, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.
- E. Blade Seals: Synthetic elastomeric, mechanically attached, field replaceable.
- F. Jamb Seals: Spring stainless steel.
- G. Shaft Bearings: Molded synthetic or stainless-steel sleeve mounted in frame..
- H. Leakage: Less than one percent based on approach velocity of 2000 ft per min and 4 inches wg.
- I. Pressure Drop: 0.05-in. wg at 1500 fpm across a 24-by-24-inch damper when tested according to AMCA 500-D, figure 5.3.
- J. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

## **2.04 DAMPER OPERATORS**

- A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
  - 1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
  - 2. Provide one operator for maximum 36 sq ft damper section.
- B. Electric Operators:
  - 1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

## **2.05 INPUT/OUTPUT SENSORS**

- A. Temperature Sensors:
  - 1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
  - 2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
  - 3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
  - 4. Temperature Sensing Device: Compatible with project DDC controllers.
  - 5. Performance Characteristics:
    - a. RTD:
      - 1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
      - 2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
      - 3) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
    - b. Thermistor:
      - 1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
      - 2) Range: Minus 25 degrees F through 122 degrees F minimum.

- c. Sensing Range:
    - 1) Provide limited range sensors if required to sense the range expected for a respective point.
    - 2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.
    - 3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.
  - d. Wire Resistance:
    - 1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
    - 2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.
  - e. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
  - f. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.
  - g. Ceiling and Recessed Mount Temperature Sensors: Ceiling-mounted sensor in a low-profile housing.
  - h. Room Temperature Sensors:
    - 1) Construct for surface or wall box mounting.
    - 2) Provide the following:
      - (a) Setpoint reset slide switch with an adjustable temperature range.
      - (b) Individual heating/cooling setpoint slide switches.
      - (c) Momentary override request push button for activation of after-hours operation.
  - i. Room Temperature Sensors with Integral Digital Display:
    - 1) Construct for surface or wall box.
    - 2) Provide a four button keypad with the following capabilities:
      - (a) Indication of space and outdoor temperatures.
      - (b) Setpoint adjustment to accommodate room setpoint and Sequence of Operation.
      - (c) Display and control fan operation status.
      - (d) Manual occupancy override and indication of occupancy status.
      - (e) Controller mode status.
      - (f) Password enabled setpoint and override modes.
- B. Humidity Sensors:
- 1. Duct Mounted Sensor: Voltage type encased in a die-cast metal, weather-proof housing.
    - a. Humidity:
      - 1) HS Element: Digitally profiled thin-film capacitive.
      - 2) Accuracy 1 percent at 10 to 80 percent relative humidity at 77 degrees F, multi-point calibration, NIST traceable.
        - (a) Plus/minus 1 percent at 20 to 40 percent RH in mA output mode; (multi-point calibration, NIST traceable).
      - 3) Scaling: 0 to 100 percent RH.
    - b. Temperature Effect:
      - 1) Duct Mounted: Plus/minus 0.18 percent per degree F.
      - 2) Outdoor Mounted: 4 to 20mA version:  $(0.0013 \times \%RH \times (T_{\text{degreeC}} - 25))$ .
    - c. Hysteresis: 1.5 percent typical.
    - d. Linearity: Included in accuracy specification.
    - e. Reset Rate: 24 hours.
    - f. Stability: Plus/minus 1 percent at 68 degrees F (20 degrees C) annually, for two years.
- C. Static Pressure (Air Pressure) Sensors:
- 1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
  - 2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
  - 3. Accuracy: One percent of full scale with repeatability 0.3 percent.

4. Output: 0 to 5 vdc with power at 12 to 28 vdc.
- D. Equipment Operation (Current) Sensors:
  1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
  2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
  3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- E. Carbon Monoxide Sensors, for Single-Gang Electrical Box Mounting:
  1. General:
    - a. Provide gas platform, wired to the building controller, with replaceable sensor.
    - b. Input Power: Class 2; 15 to 30 VDC/24 VAC plus/minus 20 percent, 50/60 Hz.
- F. Carbon Dioxide Sensors, Duct and Wall:
  1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.

## 2.06 THERMOSTATS

- A. Low-Limit Temperature Cutout Switch (low-limit thermostat or freezestat):
  1. Configuration: Digital module tied to sensor-assembly.
  2. Sensing Length: 4 feet.
  3. Setpoint Adjust: Slider.
  4. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.
  5. Mounting: Locate on cooling coil intake side.
  6. Field Interface: Connect load line-voltage to stater.
  7. Electrical Rating: Pilot duty, 125 VA at 125 to 600 VAC.
- B. Room Thermostat Accessories:
  1. Thermostat Covers: Vandal proof clear plastic..
  2. Insulating Bases: For thermostats located on exterior walls.
- C. Electric Low Limit Duct Thermostats:
  1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
  2. Bulb length: Minimum 20 feet.
  3. Provide one thermostat for every 20 sq ft of coil surface.

## 2.07 TRANSMITTERS

- A. Pressure Transmitters:
  1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.
- B. Temperature Transmitters:
  1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F span and plus or minus 1 percent for 50 degrees F span, with 50 degrees F. temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.

- G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

### **3.02 INSTALLATION**

- A. Furnish and install products required to satisfy most stringent requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Install in accordance with manufacturer's instructions.
- D. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 2726.
- E. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- F. Provide guards on thermostats in public areas and where indicated.
- G. Provide isolation (two position) dampers of parallel blade construction.
- H. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- I. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- J. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- K. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

### **END OF SECTION**

**SECTION 23 0925**  
**DIRECT-DIGITAL CONTROL (DDC) SYSTEMS FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Control Equipment
- B. Software

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions.
- C. Section 23 0005 - Basic HVAC Requirements.
- D. Section 23 0553 - Identification for HVAC Piping and Equipment.
- E. Section 23 0800 - Commissioning of HVAC.
- F. Section 23 0913 - Instrumentation and Control Devices for HVAC.
- G. Section 23 0915 - Variable Frequency Drives.
- H. Section 23 2123 - Hydronic Pumps.
- I. Section 23 3300 - Air Duct Accessories.
- J. Section 23 3423 - HVAC Power Ventilators.
- K. Section 23 5233.13 - Finned Water-Tube Boilers.
- L. Section 23 7223 - Packaged Air-to-Air Energy Recovery Units.
- M. Section 23 7413 - Packaged Outdoor Central-Station Air-Handling Units.
- N. Section 23 8148 - Water Source Heat Pumps.
- O. Division 26 - Electrical.

**1.03 REFERENCE STANDARDS**

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.04 PRODUCT INSTALLED BUT NOT FURNISHED UNDER THIS SECTION**

- A. Section 23 0913 - Instrumentation and Control Devices for HVAC:
  - 1. Duct static pressure sensors
  - 2. H2O Pressure Differential/Flow Switches
- B. Section 28 4600 - Fire Detection and Alarm:
  - 1. Smoke Detectors/Fire Stats

**1.05 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION**

- A. General:
  - 1. Coordination Meeting: The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting.
- B. Section 23 3600 - Air Terminal Units:
  - 1. VAV boxes: VAV Terminal Units shall be furnished configured to accept control inputs from an external building automation system controller as specified in Section 23 09 93. Factory mounted safeties and other controls shall not interfere with this controller.
- C. Section 23 8000 - Decentralized HVAC Equipment:

1. Unit ventilators, unit heaters, fan coils, etc.: Unit ventilators, unit heaters, fan coils, cabinet heaters, convective or fin tube heaters, zone reheat, and similar terminal units: These units shall be furnished configured to accept control inputs from an external building automation system controller. Factory mounted safeties and other controls shall not interfere with this controller.
- D. Communications with Third Party Equipment:
  1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a open protocol network interface for integration into the Direct Digital Control System described in this section.

#### **1.06 DESCRIPTION**

- A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
- B. The system shall directly control HVAC equipment as detailed on the drawings. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints as specified in the sequence.
- C. System shall use open protocol communications to the operator workstation or web server and for communication between control modules.

#### **1.07 APPROVED CONTROL SYSTEMS INSTALLERS**

- A. Michigan Environmental Controls.
- B. Metro Environmental.
- C. Johnson Controls.
- D. Trane.
- E. BASS.
- F. Siemens.
- G. Honeywell.
- H. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.
  1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless the Owner approves use of multiple manufacturers.

#### **1.08 QUALITY ASSURANCE**

- A. Installer and Manufacturer Qualifications
  1. Installer shall have an established working relationship with the Control System Manufacturer.
  2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.
- B. Perform work in accordance with NFPA 70.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

#### **1.09 CODES AND STANDARDS**

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
  1. National Electric Code (NEC)
  2. International Building Code (IBC)

- a. Section 719 Ducts and Air Transfer Openings
- b. Section 907 Fire Alarm and Detection Systems
- c. Section 909 Smoke Control Systems
- d. Chapter 28 Mechanical
- 3. International Mechanical Code (IMC)
- 4. ANSI/ASHRAE 135-2004: Data Communication Protocol for Building Automation and Control Systems (BACNET)

#### 1.10 SYSTEM PERFORMANCE

- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
  - 1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
  - 2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
  - 3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
  - 4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
  - 5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
  - 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
  - 7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
  - 8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
  - 9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy as listed below:
    - a. Space Temperature: +/- 1 degrees F
    - b. Ducted Air: +/- 1 degrees F
    - c. Outside Air: +/- 2 degrees F
    - d. Dew Point: +/- 3 degrees F
    - e. Water Temperature: +/- 1 degrees F
    - f. Delta-T: +/- 0.25 degrees F
    - g. Relative Humidity: +/- 5% RH
    - h. Water Flow: +/- 2% of full scale
    - i. Airflow (terminal): +/- 10% of full scale
      - 1) Accuracy applies to 10% - 100% of scale
    - j. Airflow (measuring stations): +/- 5% of full scale
    - k. Air Pressure (ducts): +/- 0.1 in. w.g.
    - l. Air Pressure (space): +/- 0.01 in. w.g.
    - m. Water Pressure: +/- 2% of full scale
      - 1) For both absolute and differential pressure
    - n. Electrical (A, V, W, Power Factor): +/- 1% of reading
      - 1) Not including utility supplied meters
    - o. Carbon Monoxide (CO): +/- 5% of reading
    - p. Carbon Dioxide (CO2): +/- 50 ppm
  - 10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances as listed below:
    - a. Air Pressure (0 to 6 in. w.g.): +/- 0.2 in. w.g.
    - b. Air Pressure (-0.1 to 0.1 in. w.g.): +/- 0.01 in. w.g.
    - c. Airflow: +/- 10% of full scale
    - d. Space Temperature: +/- 2.0 degrees F
    - e. Duct Temperature: +/- 3 degrees F
    - f. Humidity: +/- 5% RH

- g. Fluid Pressure (1 to 150 psi): +/- 1.5 psi
- h. Fluid Pressure (0 to 50 in. w.g. differential): +/- 1.0 in. w.g.

## 1.11 SUBMITTALS

- A. Direct Digital Control System Hardware
  - 1. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
  - 2. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
    - a. Direct digital controllers (controller panels)
    - b. Transducers and transmitters
    - c. Sensors (include accuracy data)
    - d. Actuators
    - e. Valves
    - f. Relays and switches
    - g. Control panels
    - h. Power supplies
    - i. Batteries
    - j. Operator interface equipment
    - k. Wiring
  - 3. Wiring diagrams and layouts for each control panel. Show termination numbers.
  - 4. Floor plan schematic diagrams indicating field sensor and controller locations.
  - 5. Riser diagrams showing control network layout, communication protocol, and wire types.
- B. Central System Hardware and Software
  - 1. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.
  - 2. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
    - a. Central Processing Unit (CPU) or web server
    - b. Monitors
    - c. Keyboards
    - d. Power supplies
    - e. Battery backups
    - f. Interface equipment between CPU or server and control panels
    - g. Operating System software
    - h. Operator interface software
    - i. Color graphic software
    - j. Third-party software
  - 3. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
  - 4. Network riser diagrams of wiring between central control unit and control panels.
- C. Controlled Systems
  - 1. Riser diagrams showing control network layout, communication protocol, and wire types.
  - 2. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
  - 3. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
  - 4. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
  - 5. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.



- D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

## **1.12 WARRANTY**

- A. Warrant work as follows:
  - 1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
  - 2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
  - 3. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
  - 4. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

## **1.13 OWNERSHIP OF PROPRIETARY MATERIAL**

- A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
  - 1. Graphics
  - 2. Record drawings
  - 3. Database
  - 4. Application programming code
  - 5. Documentation

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

### **2.02 COMMUNICATION**

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise an open protocol internetwork.
- B. Install new wiring and network devices as required to provide a complete and workable control network.
- C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
  - 1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
  - 2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies. An authorized operator shall be able to edit cross-controller links by typing a standard object address

or by using a point-and-click interface.

- E. Controllers with real-time clocks shall synchronize with the building management system. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.
- F. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.
- G. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.
  - 1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.
  - 2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
  - 3. For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.
  - 4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

## **2.03 OPERATOR INTERFACE**

- A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. In addition to the primary operator interface, the system shall include a secondary interface compatible with a locally available commercial wireless network and viewable on a commercially available wireless device such as a Wireless Access Protocol (WAP) enabled cellular telephone or personal digital assistant (PDA). This secondary interface may be text-based and shall provide a summary of the most important data. As a minimum, the following capabilities shall be provided through this interface:
  - 1. An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.
  - 2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.
  - 3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.
  - 4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.
- B. Communication. Web server or workstation and controllers shall communicate using an open protocol communications language. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol.
- C. Hardware. Each workstation or web server shall consist of the following:
  - 1. Hardware Base. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times as specified. Hard disk shall have sufficient memory to store system software, one year of data for trended points, and a system database at least twice the size of the existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance. Web

- server or workstations shall be IBM-compatible PCs with a minimum of:
- a. Intel Pentium 2.66 GHz processor
  - b. 1 GB RAM
  - c. 40 GB hard disk providing data at 100 MB/sec
  - d. 48x CD-ROM drive
  - e. Serial, parallel, and network communication ports and cables required for proper system operation
2. Modem. Auto-dial modem and associated cables shall transmit over voice-grade telephone lines at a nominal 56,000 baud and shall provide communication between workstation or web server and remote buildings and workstations.
- D. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:
1. Log In and Log Out. System shall require user name and password to log in to operator interface.
  2. Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.
  3. View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.
  4. View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.
  5. View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.
  6. View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.
  7. View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.
  8. Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.
  9. Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.
- E. System Software.
1. Operating System. Web server shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows XP Pro, Red Hat Linux, or Sun Solaris. Coordinate operating system type with the Owner.
  2. System Graphics. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
    - a. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.
    - b. Animation. Graphics shall be able to animate by displaying different image files for changed object status.
    - c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
    - d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers

compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

- F. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.
1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
  2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.
  3. System Configuration. Operators shall be able to configure the system.
  4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.
  5. Security. System shall require a user name and password to view, edit, add, or delete data.
    - a. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.
    - b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.
    - c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
  6. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).
  7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as detailed on the drawings.
  8. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.
  9. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.
  10. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.
  11. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk.
  12. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.
  13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
  14. Standard Reports. Furnish the following standard system reports:

- a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
- b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
- c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
  - 1) Alarm History.
  - 2) Trend Data. Operator shall be able to select trends to be logged.
  - 3) Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.
- 15. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.
- 16. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.
- 17. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.
- 18. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:
  - a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.
  - b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.
  - c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
  - d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.
  - e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
  - f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.
  - g. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.
    - 1) Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

- 2) System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.
- G. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

## 2.04 CONTROLLER SOFTWARE

- A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.
- B. Scheduling. System shall provide the following schedule options as a minimum:
  1. Weekly. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
  2. Exception. Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.
  3. Holiday. Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.
- C. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.
- D. Binary and Analog Alarms. See Paragraph 2.3.F.7 (Alarm Processing).
- E. Alarm Reporting. See Paragraph 2.3.F.9 (Alarm Reactions).
- F. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.
- G. Maintenance Management. System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits.
- H. Sequencing. Application software shall sequence chillers, boilers, and pumps as detailed on the drawings.
- I. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.
- J. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.
- K. Energy Calculations.
  1. System shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
  2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.
- L. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.
- M. On and Off Control with Differential. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.
- N. Runtime Totalization. System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit.

## 2.05 CONTROLLERS

- A. General. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified.

- B. Communication.
  - 1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
  - 2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
  - 3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
  - 4. Stand-Alone Operation. Each piece of equipment specified shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.
- C. Environment. Controller hardware shall be suitable for anticipated ambient conditions.
  - 1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
  - 2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- D. Keypad. Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.
- E. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.
- F. Serviceability.
  - 1. Controllers shall have diagnostic LEDs for power, communication, and processor.
  - 2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
  - 3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.
- G. Memory.
  - 1. Controller memory shall support operating system, database, and programming requirements.
  - 2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
  - 3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.
- H. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
- I. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

## **2.06 INPUT AND OUTPUT INTERFACE**

- A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.
- B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.
- C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

- D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.
- E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.
- G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.
- H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.
- I. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

## **2.07 POWER SUPPLIES AND LINE FILTERING**

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
  - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
    - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
    - b. Line voltage units shall be UL recognized and CSA listed.
- B. Power Line Filtering.
  - 1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
  - 2. Dielectric strength of 1000 V minimum
  - 3. Response time of 10 nanoseconds or less
  - 4. Transverse mode noise attenuation of 65 dB or greater
  - 5. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

## **2.08 AUXILIARY CONTROL DEVICES**

- A. Local Control Panels.
  - 1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.
  - 2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.
  - 3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

## **2.09 WIRING AND RACEWAYS**

- A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.
- B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.



## **2.10 FIBER OPTIC CABLE SYSTEM**

- A. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.
- B. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.
- B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.
- C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 0923 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

### **3.02 PROTECTION**

- A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.
- B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

### **3.03 COORDINATION**

- A. Site.
  - 1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
  - 2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.
- B. Test and Balance.
  - 1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
  - 2. Train Test and Balance Contractor to use control system interface tools.
  - 3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
  - 4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.
- C. Life Safety.
  - 1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as indicated on drawings.
  - 2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as indicated on drawings.
  - 3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.
- D. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.
  - 1. Communication media and equipment shall be provided as specified.
  - 2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation detailed on the drawings.

3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

#### **3.04 GENERAL WORKMANSHIP**

- A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
- B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

#### **3.05 FILED QUALITY CONTROL**

- A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances.
- B. Continually monitor field installation for code compliance and workmanship quality.
- C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

#### **3.06 WIRING**

- A. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 23 differ from Division 26, Section 23 09 23 shall take precedence.
- B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.
- C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.
- D. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.
- E. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.
- F. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.
- G. Do not install wiring in raceway containing tubing.
- H. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.
- I. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.
- J. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.
- K. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.
- L. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
- M. Use color-coded conductors throughout.
- N. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

- O. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.
- P. Adhere to requirements in Division 26 where raceway crosses building expansion joints.
- Q. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.
- R. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.
- S. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.
- T. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

### **3.07 COMMUNICATION WIRING**

- A. Communication wiring shall be low-voltage Class 2 wiring.
- B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.
- C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.
- D. Verify entire network's integrity following cable installation using appropriate tests for each cable.
- E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.
- F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.
- G. Label communication wiring to indicate origination and destination.
- H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

### **3.08 FIBER OPTIC CABLE**

- A. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- B. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

### **3.09 INSTALLATION OF SENSORS**

- A. Install sensors according to manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for operating environment.
- C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.
- D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.
- E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.
- F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m2 (1 ft2) of coil area.
- G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

- H. Install outdoor air temperature sensors on north wall at designated location with sun shield.
- I. Differential Air Static Pressure.
  - 1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
  - 2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
  - 3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.
  - 4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
  - 5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
  - 6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.
- J. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

### **3.10 WARNING LABELS**

- A. Affix permanent warning labels to equipment that can be automatically started by the control system.
  - 1. Labels shall use white lettering (12-point type or larger) on a red background.
  - 2. Warning labels shall read as follows.
    - a. C A U T I O N: This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing
- B. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
  - 1. Labels shall use white lettering (12-point type or larger) on a red background.
  - 2. Warning labels shall read as follows.
    - a. C A U T I O N: This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

### **3.11 IDENTIFICATION OF HARDWARE AND WIRING**

- A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.
- B. Permanently label or code each point of field terminal strips to show instrument or item served.
- C. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- D. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.
- E. Label room sensors related to terminal boxes or valves with nameplates.
- F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
- G. Label identifiers shall match record documents.

### **3.12 PROGRAMMING**

- A. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.
  - 1. Application Programming. Provide application programming that adheres to the sequences of operation. Program documentation or comment statements shall reflect language used in sequences of operation.
  - 2. System Programming. Provide system programming necessary for system operation.

- B. Operator Interface.
  - 1. Standard Graphics. Provide graphics as specified in Section 23 09 23 Article 2.3 Paragraph E.2 (System Graphics). Show on each equipment graphic input and output points and relevant calculated points. Point information on graphics shall dynamically update.
  - 2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation).

### **3.13 CONTROL SYSTEM CHECKOUT AND TESTING**

- A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.
  - 1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 23.
  - 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
  - 3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
  - 4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
  - 5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
  - 6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
  - 7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
  - 8. Alarms and Interlocks.
    - a. Check each alarm with an appropriate signal at a value that will trip the alarm.
    - b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
    - c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

### **3.14 CLEANING**

- A. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

### **3.15 TRAINING**

- A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.
- B. Training shall enable students to accomplish the following objectives.
  - 1. Proficiently operate system
  - 2. Understand control system architecture and configuration
  - 3. Understand DDC system components
  - 4. Understand system operation, including DDC system control and optimizing routines (algorithms)
  - 5. Operate workstation and peripherals
  - 6. Log on and off system
  - 7. Access graphics, point reports, and logs
  - 8. Adjust and change system setpoints, time schedules, and holiday schedules
  - 9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools

10. Understand system drawings and Operation and Maintenance manual
  11. Understand job layout and location of control components
  12. Access data from DDC controllers
  13. Operate portable operator's terminals
  14. Create and change system graphics
  15. Create, delete, and modify alarms, including configuring alarm reactions
  16. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
  17. Configure and run reports
  18. Add, remove, and modify system's physical points
  19. Create, modify, and delete application programming
  20. Add operator interface stations
  21. Add a new controller to system
  22. Download firmware and advanced applications programming to a controller
  23. Configure and calibrate I/O points
  24. Maintain software and prepare backups
  25. Interface with job-specific, third-party operator software
  26. Add new users and understand password security procedures
- C. Divide presentation of objectives into three sessions (1-13, 14-23, and 24-26). Participants will attend one or more of sessions, depending on knowledge level required.
1. Day-to-day Operators (objectives 1-13)
  2. Advanced Operators (objectives 1-13 and 14-23)
  3. System Managers and Administrators (objectives 1-13 and 24-26)
- D. Provide course outline and materials according to Section 23 09 23 Article 1.10 (Submittals). Provide one copy of training material per student.
- E. Instructors shall be factory-trained and experienced in presenting this material.
- F. Perform classroom training using a network of working controllers representative of installed hardware.

**END OF SECTION**

**SECTION 23 3100  
HVAC DUCTS AND CASINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Single-wall rectangular ducts and fittings.
- B. Single-wall round ducts and fittings.
- C. Sheet metal materials.
- D. Sealants and gaskets.
- E. Hangers and supports.

**1.02 RELATED REQUIREMENTS**

- A. Division 03 - Concrete
- B. Division 07 - Thermal Moisture Protection: Firestopping
- C. Section 23 0005 - Basic HVAC Requirements
- D. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
- E. Section 23 0713 - Duct Insulation: External insulation and duct liner.
- F. Section 23 3300 - Air Duct Accessories.
- G. Section 23 3700 - Air Outlets and Inlets.

**1.03 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.
- I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.
- K. UL 1978 - Grease Ducts Current Edition, Including All Revisions.
- L. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies Current Edition, Including All Revisions.

**1.04 PERFORMANCE REQUIREMENTS**

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide data for duct materials, duct liner, duct connections, and factory fabricated fittings.
- C. Shop Drawings: Submit 1/4 scale, double line shop drawings that indicate duct fittings, duct size, bottom of duct elevations, necessary offsets to accommodate building structure, particulars such as gages, sizes, welds, elevations, all fittings, and configuration prior to start of work for all systems.

## **1.06 REGULATORY REQUIREMENTS**

- A. Construct ductwork to SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 1995, Second Edition with Addendum No. 1.

## **PART 2 PRODUCTS**

### **2.01 SINGLE-WALL RECTANGULAR DUCT AND FITTING ASSEMBLIES**

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### **2.02 SINGLE-WALL ROUND SUCT AND FITTING ASSEMBLIES**

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. McGill AirFlow LLC.
    - b. Spiral Manufacturing Co., Inc.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."



1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.03 MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  1. Galvanized Coating Designation: G90.
  2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- D. Galvanealed Sheet Steel (FOR EXPOSED, PAINTED DUCTWORK): Comply with ASTM A653-09; hot dipped zinc iron coated steel, annealed, coating designation "A" (A60, A40)
- E. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- F. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- I. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

## 2.04 SEALANTS AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
  1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 3 inches.
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant
  6. Maximum Static-Pressure Class: 10-in wg, positive and negative
  7. Service: Indoor and outdoor
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.
  - 3. Shore A Hardness: Minimum 20.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. VOC: Maximum 75 g/L (less water).
  - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  - 8. Service: Indoor or outdoor.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
  - 1. General: Single-component, acid-curing, silicone, elastomeric.
  - 2. Type: S.
  - 3. Grade: NS.
  - 4. Class: 25.
  - 5. Use: O.
  - 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
  - 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg pressure class, positive or negative.

## **2.05 HANGERS AND SUPPORTS**

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## **2.06 DUCTWORK FABRICATION**

- A. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Provide turning vanes in all mitered elbows.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- D. T's, bends, and elbows: construct according to SMACNA (DCS).
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence

downstream.

- F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- G. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

## **2.07 MANUFACTURED DUCTWORK AND FITTINGS**

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Flat Oval Ducts: Machine made from round spiral lockseam duct.
  - 1. Manufacture in accordance with SMACNA (DCS).
  - 2. Fittings: Manufacture at least two gages heavier metal than duct.
  - 3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
  - 1. UL labeled.
  - 2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
  - 3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
  - 4. Maximum Velocity: 4000 fpm.
  - 5. Temperature Range: Minus 20 degrees F to 175 degrees F.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- D. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- E. Install round ducts in maximum practical lengths.
- F. Install ducts with fewest possible joints.
- G. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- H. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- K. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- L. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- M. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- N. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- P. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.
- Q. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- R. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- S. Use double nuts and lock washers on threaded rod supports.

### **3.02 HANGERS AND SUPPORT INSTALLATION**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### **3.03 INSTALLATION OF EXPOSED DUCTWORK**

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### **3.04 DUCT SEALING**

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and

Flexible."

- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.
  - 13. All locations, Laboratory Exhaust Ducts: Seal Class A.

### **3.05 DUCT CLEANING**

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
  - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
  - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  - 4. Coils and related components.
  - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  - 6. Supply-air ducts, dampers, actuators, and turning vanes.
  - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
  - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

### **3.06 FIELD QUALITY CONTROLS**

- A. Perform tests and inspections.
- B. Leakage Tests:
  1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  2. Test the following systems:
    - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
  3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  4. Keep open ends of ductwork covered during construction.
  5. Test for leaks before applying external insulation.
  6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
  1. Visually inspect duct system to ensure that no visible contaminants are present.
  2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCAACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### **3.07 SCHEDULES**

- A. Supply Ducts:
  1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive 1-inch wg.
    - b. Minimum SMACNA Seal Class: C.
    - c. SMACNA Leakage Class for Rectangular: 12
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.
  2. Ducts Connected to Constant-Volume Air-Handling Units:
    - a. Pressure Class: Positive 4-inch wg.
    - b. Minimum SMACNA Seal Class: A.
    - c. SMACNA Leakage Class for Rectuangular: 6.
    - d. SMACNA Leakage Class for Round and Flat Oval: 3.
  3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
    - a. Pressure Class: Positive 4-inch wg.
    - b. Minimum SMACNA Seal Class: A.
    - c. SMACNA Leakage Class for Rectangular: 6.
    - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- B. Return Ducts:
  1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive or negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.
  - 2. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 4-inch wg.
    - b. Minimum SMACNA Seal Class: A.
    - c. SMACNA Leakage Class for Rectangular: 6.
    - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Exhaust Ducts:
- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 24.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
  - 2. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
    - a. Type 316, stainless-steel sheet.
      - 1) Exposed to View: No. 4 finish.
      - 2) Concealed: No. 2D finish.
    - b. Pressure Class: Positive or negative 6-inch wg.
    - c. Minimum SMACNA Seal Class: A.
    - d. SMACNA Leakage Class: 3.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
- 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.
  - 2. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- E. Intermediate Reinforcement:
- 1. Stainless-Steel Ducts:
    - a. Exposed to Airstream: Match duct material.
    - b. Not Exposed to Airstream: Match duct material.
- F. Elbow Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm:
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90 degree elbow.
    - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90 degree elbow.
    - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90 degree elbow.
    - 4) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- G. Branch Configuration:
  1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.
      - 1) Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - c. Velocity 1000 fpm or Lower: 90-degree tap.
    - d. Velocity 1000 to 1500 fpm: Conical tap.
    - e. Velocity 1500 fpm or Higher: 45-degree lateral.

**END OF SECTION**



**SECTION 23 3300  
AIR DUCT ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Backdraft dampers - fabric.
- D. Combination fire and smoke dampers.
- E. Duct access doors.
- F. Duct test holes.
- G. Fire dampers.
- H. Flexible duct connectors.
- I. Volume control dampers.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project procedural and administrative requirements.
- B. Division 07 - Thermal and Moisture Protection: Firestopping
- C. Section 23 0005 - Basic HVAC Requirements
- D. Section 23 3100 - HVAC Ducts and Casings.
- E. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

**1.03 REFERENCE STANDARDS**

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- B. NFPA 92 - Standard for Smoke Control Systems 2018.
- C. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- E. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
- F. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
- G. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

**1.05 QUALITY ASSURANCE**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**PART 2 PRODUCTS**

**2.01 AIR TURNING DEVICES/EXTRACTORS**

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

**2.02 BACKDRAFT DAMPERS - METAL**

- A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

**2.03 BACKDRAFT DAMPERS - FABRIC**

- A. Fabric Backdraft Dampers: Factory-fabricated.
  - 1. Blades: Neoprene coated fabric material.
  - 2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
  - 3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

#### **2.04 COMBINATION FIRE AND SMOKE DAMPERS**

- A. Manufacturers:
  - 1. Nailor Industries, Inc: [www.nailor.com](http://www.nailor.com).
  - 2. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
  - 3. United Enertech: [www.unitedenertech.com](http://www.unitedenertech.com).
  - 4. Greenheck: [www.greenheck.com](http://www.greenheck.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper.
- D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.
- F. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
- G. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

#### **2.05 DUCT ACCESS DOORS**

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.

#### **2.06 DUCT TEST HOLES**

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

#### **2.07 FIRE DAMPERS**

- A. Manufacturers:
  - 1. Nailor Industries, Inc: [www.nailor.com](http://www.nailor.com).
  - 2. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
  - 3. United Enertech: [www.unitedenertech.com](http://www.unitedenertech.com).
  - 4. Greenheck: [www.greenheck.com](http://www.greenheck.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- D. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

#### **2.08 FLEXIBLE DUCT CONNECTORS**

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

#### **2.09 VOLUME CONTROL DAMPERS**

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.

- B. Single Blade Dampers:
  - 1. Blade: 24 gage, 0.0239 inch, minimum.
- C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
  - 1. Blade: 18 gage, 0.0478 inch, minimum.
- D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- E. Quadrants:
  - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

### **END OF SECTION**

**SECTION 23 3423  
HVAC POWER VENTILATORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Roof exhausters.

**1.02 RELATED REQUIREMENTS**

- A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 23 3300 - Air Duct Accessories: Backdraft dampers.
- C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

**1.03 REFERENCE STANDARDS**

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2005 (Reaffirmed 2012).
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

**1.04 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

**1.05 FIELD CONDITIONS**

- A. Permanent ventilators may not be used for ventilation during construction.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Greenheck Fan Corporation: [www.greenheck.com](http://www.greenheck.com).
- B. Loren Cook Company: [www.lorencook.com](http://www.lorencook.com).
- C. PennBarry, Division of Air System Components: [www.pennbarry.com](http://www.pennbarry.com).

**2.02 POWER VENTILATORS - GENERAL**

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**2.03 ROOF EXHAUSTERS**

- A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- B. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Hung Cabinet Fans:
  - 1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 22 0548.
  - 2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on inlet to roof and wall exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

**END OF SECTION**

**SECTION 23 3700  
AIR OUTLETS AND INLETS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Diffusers:
  - 1. Perforated ceiling diffusers.
  - 2. Rectangular ceiling diffusers.
- B. Registers/grilles:
  - 1. Ceiling-mounted, egg crate exhaust and return register/grilles.
  - 2. Wall-mounted, supply register/grilles.
  - 3. Wall-mounted, exhaust and return register/grilles.
- C. Duct-mounted supply and return registers/louvers.
- D. Louvers:

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project procedural and administrative requirements.
- B. Division 09 - Finishes: Painting of ducts and visible behind outlets and inlets.
- C. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

**1.03 REFERENCE STANDARDS**

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2015.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets 2006 (Reaffirmed 2011).

**1.04 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

**1.05 QUALITY ASSURANCE**

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Krueger-HVAC: [www.krueger-hvac.com](http://www.krueger-hvac.com).
- B. Price Industries: [www.price-hvac.com](http://www.price-hvac.com).
- C. Titus, a brand of Air Distribution Technologies: [www.titus-hvac.com](http://www.titus-hvac.com).

**2.02 RECTANGULAR CEILING DIFFUSERS**

- A. Type: Provide square, plaque face diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.
- B. Connections: Round.
- C. Frame: Provide surface mount and inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel with baked enamel finish.
- E. Color: As indicated.
- F. Accessories: Provide radial opposed blade volume control damper; [ ] with damper adjustable from diffuser face.

**2.03 PERFORATED FACE CEILING DIFFUSERS**

- A. Type: Perforated face with fully adjustable pattern and removable face.
- B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

- C. Fabrication: Steel with steel frame and baked enamel finish.
- D. Color: As indicated.
- E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

#### **2.04 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS**

- A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.
- B. Material: 22 gage, 0.0299 inch.
- C. Color: As indicated on drawings.

#### **2.05 CEILING EGG CRATE EXHAUST AND RETURN GRILLES**

- A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.
- B. Fabrication: Grid core consists of aluminum with mill aluminum finish.
- C. Color: As indicated.
- D. Frame: 1-1/4 inch margin with countersunk screw mounting.
- E. Accessories: Provide integral, gang & face operated opposed blade damper and [ ].

#### **2.06 WALL SUPPLY REGISTERS/GRILLES**

- A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
- D. Color: As indicated.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

#### **2.07 WALL EXHAUST AND RETURN REGISTERS/GRILLES**

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Steel frames and blades, with factory baked enamel finish.
- D. Color: As indicated on the drawings.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

#### **2.08 LOUVERS**

#### **2.09 INTAKE AND RELIEF LOUVERS**

- A. Louver Manufacturers:
  - 1. Greenheck .
  - 2. Ruskin.
- B. Quality Assurance:
  - 1. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.
- C. Fabrication:
  - 1. Frame:
    - a. Material: Extruded aluminum, Alloy 6063-T5.
    - b. Wall Thickness: 0.081 inch (2.1mm), nominal.
    - c. Depth: 6 inches.

- d. Downspouts and caulking surfaces.
- 2. Blades:
  - a. Style: Drainable.
  - b. Material: Extruded aluminum, Alloy 6063-T5.
  - c. Wall Thickness: 0.081 inch (2.1mm), nominal.
  - d. Angle: 37 degrees.
  - e. Centers: 6 inches.
- 3. Bird Screen:
  - a. Material: Aluminum, 3/4 inch x 0.51 inch expanded, flattened.
  - b. Frame: Removeable, rewirable.
- 4. Gutters: Drain gutters in head frame at each blade.
- 5. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
- 6. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.
- 7. Sill: Steeply angles integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
- 8. Assembly: Factory assemble louver components.
- D. Performance Data:
  - 1. Design Load: Incorporate structural supports required to withstand wind load of 25 pounds per square foot (100 mph wind equivalent).
- E. Accessories:
  - 1. Blank-Off Panels: 0.063 inch extruded aluminum, 2 inch insulated core finish to match louver.
  - 2. Insect Screen: Aluminum mech construction.
- F. Factory Finish:
  - 1. Baked Enamel Finish:
    - a. Color shall be as selected by architect.
    - b. Finish to be applied after a thorough cleaning and preparation of the metal surface.
    - c. Total dry film thickness: 1.2 mils.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

### **END OF SECTION**



**SECTION 23 5100  
BREECHINGS, CHIMNEYS, AND STACKS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Double wall metal stacks.

**1.02 REFERENCE STANDARDS**

- A. NFPA 54 - National Fuel Gas Code 2018.
- B. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2019.
- C. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances Current Edition, Including All Revisions.

**1.03 DESIGN REQUIREMENTS**

- A. Factory built vents and chimneys used for venting natural draft appliances to comply with NFPA 211 and be UL listed and labeled.

**1.04 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory built units are used.
- D. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.
- E. Manufacturer's Certificate: Certify that refractory lined metal stacks meet or exceed specified requirements.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. AMPCO by Hart & Cooley, Inc: [www.ampcostacks.com](http://www.ampcostacks.com).
- B. DuraVent: [www.duravent.com](http://www.duravent.com).
- C. Metal-Fab, Inc [www.mtlfab.com](http://www.mtlfab.com).
- D. Schebler Chiminer: [www.scheblerchimney.com](http://www.scheblerchimney.com)
- E. Security Chimneys International: [www.securitychimneys.com](http://www.securitychimneys.com).
- F. Selkirk Corporation: [www.selkirkcommercial.com](http://www.selkirkcommercial.com).
- G. Z-Flex U.S. Inc : [www.z-flex.com](http://www.z-flex.com).

**2.02 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL REQUIREMENTS**

- A. Regulatory Requirements:
  - 1. Comply with applicable codes for installation of natural gas burning appliances and equipment.
  - 2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**2.03 DOUBLE WALL METAL STACKS**

- A. Provide double wall metal stacks, tested to UL 103 and UL listed with positive pressure rating, for use with building heating equipment, in compliance with NFPA 211.
- B. Fabricate with 1 inch minimum air space between walls and construct inner liner of AL29-4C stainless steel and outer jacket of 304 stainless steel.
  - 1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.

- C. Accessories, UL labeled:
  - 1. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.
  - 2. Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.
- C. Level and plumb chimney and stacks.

#### **3.02 SCHEDULES**

- A. Breechings, Chimneys and Stacks.
  - 1. Condensing Boiler or Water Heater: Double Wall Metal Stack

**END OF SECTION**

## **SECTION 23 5400 FURNACES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Forced air furnaces.

#### **1.02 REFERENCE STANDARDS**

- A. ANSI Z21.47 - American National Standard for Gas-Fired Central Furnaces 2016.
- B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers 2017, with Errata (2019).
- D. NFPA 54 - National Fuel Gas Code 2018.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2018.
- H. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2019.

#### **1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Trane Inc, a subsidiary of Ingersoll Rand: [www.trane.com/#sle](http://www.trane.com/#sle).
- B. York International Corporation / Johnson Controls: [www.york.com/#sle](http://www.york.com/#sle).
- C. Lennox.

#### **2.02 GAS FIRED FURNACES**

- A. Annual Fuel Utilization Efficiency (AFUE): 0.95 ("condensing") in accordance with ASHRAE Std 103.
- B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, humidifier, and accessories; wired for single power connection with control transformer.
  - 1. Safety certified by CSA in accordance with ANSI Z21.47.
  - 2. Venting System: Direct.
  - 3. Combustion: Sealed.
  - 4. Air Flow Configuration: Upflow.
  - 5. Heating: Natural gas fired.
- C. Performance:
  - 1. Refer to Furnace Schedule. Gas heating capacities are sea level ratings.
- D. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner. If not certified for combustible flooring, please provide additional steel base.
- E. Primary Heat Exchanger:
  - 1. Material: Hot-rolled steel.
  - 2. Shape: Tubular type.

- F. Secondary Heat Exchanger:
  - 1. Material: Aluminized steel.
  - 2. Shape: [\_\_\_\_\_].
- G. Gas Burner:
  - 1. Atmospheric type with adjustable combustion air supply.
  - 2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
  - 3. Electronic pilot ignition, with electric spark igniter.
  - 4. Combustion air damper with synchronous spring return damper motor.
  - 5. Non-corrosive combustion air blower with permanently lubricated motor.
- H. Gas Burner Safety Controls:
  - 1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
  - 2. Flame rollout switch: Installed on burner box and prevents operation.
  - 3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
  - 4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- I. Supply Fan: Centrifugal type rubber mounted with direct drive with adjustable variable pitch motor pulley.
- J. Motor:
  - 1. 1750 rpm single-speed, permanently lubricated, hinge mounted.
- K. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.
- L. Operating Controls:
  - 1. Room Thermostat: Cycles burner to maintain room temperature setting.
  - 2. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation. Provide continuous low speed fan operation.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and located correctly.
- C. Verify that proper fuel supply is available for connection.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and requirements of authorities having jurisdiction.
- B. Install in accordance with NFPA 90A.
- C. Install gas fired furnaces in accordance with NFPA 54.
- D. Provide vent connections in accordance with NFPA 211.

### **END OF SECTION**

**SECTION 23 6213**  
**PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSER UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Condensing unit package.
- B. Charge of refrigerant and oil.
- C. Controls and control connections.
- D. Refrigerant piping connections.
- E. Motor starters.
- F. Electrical power connections.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 2300 - Refrigerant Piping.

**1.03 REFERENCE STANDARDS**

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2008, Including All Addenda.
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants 2019, with Errata (2020).
- C. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant 2019.
- D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. ASHRAE Std 90.2 - Energy-Efficient Design of Low-Rise Residential Buildings 2018.

**1.04 SUBMITTALS**

- A. Product Data: Provide rated capacities, weights specialties and accessories, electrical nameplate data, and wiring diagrams. Include equipment served by condensing units in submittal, or submit at same time, to ensure capacities are complementary.
- B. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Trane, a brand of Ingersoll Rand: [www.trane.com/#sle](http://www.trane.com/#sle).
- B. York International Corporation/Johnson Controls, Inc: [www.york.com/#sle](http://www.york.com/#sle).
- C. Lennox.

**2.02 PERFORMANCE REQUIREMENTS**

**2.03 MANUFACTURED UNITS**

- A. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, wind deflector, and screens.
- B. Construction and Ratings: In accordance with AHRI 210/240. Test in accordance with ASHRAE Std 23.1.
- C. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1.

**2.04 CASING**

- A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

- B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.
- C. Provide removable access doors or panels with quick fasteners and piano hinges.

## **2.05 CONDENSER COILS**

- A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

## **2.06 FANS AND MOTORS**

- A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.

## **2.07 COMPRESSORS**

- A. Compressor: Semi-hermetic reciprocating type.
- B. Mounting: Statically and dynamically balance rotating parts and mount on spring vibration isolators.
- C. Lubrication System: Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.
- D. Motor: Constant speed 1800 rpm suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter.
- E. Capacity Reduction Equipment: Suction valve unloaders, with lifting mechanism operated by electrically actuated solenoid valve, with unloaded compressor start; controlled from suction pressure.
- F. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater continuously when compressor is not operating.

## **2.08 REFRIGERANT CIRCUIT**

- A. Provide each unit with one refrigerant circuit, factory supplied and piped. Refer to Section 23 2300.

# **PART 3 EXECUTION**

## **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's installation instructions.
- B. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

## **3.02 SYSTEM STARTUP**

- A. Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.
- B. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

## **END OF SECTION**

**SECTION 23 6313**  
**AIR COOLED REFRIGERANT CONDENSERS**

**<<<< UPDATE NOTES**

**PART 2 PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

**END OF SECTION**

**SECTION 23 7413  
PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Packaged roof top unit.
- B. Unit controls.
- C. Roof mounting curb and base.
- D. Maintenance service.

**1.02 RELATED REQUIREMENTS**

- A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

**1.03 REFERENCE STANDARDS**

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2008, Including All Addenda.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment 2015.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

**PART 2 PRODUCTS**

**2.01 MANUFACTURED UNITS**

- A. General: Roof mounted units having gas burner and electric refrigeration.
- B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, heat recovery coil, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

**2.02 FABRICATION**

- A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.
- B. Heat Exchangers: Aluminized steel, of welded construction.
- C. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted motor or direct drive as indicated. Refer to Section 22 0548.

**2.03 BURNER**

- A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

**2.04 EVAPORATOR COIL**



- A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.
- B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

## **2.05 COMPRESSOR**

- A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

## **2.06 CONDENSER COIL**

- A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

## **2.07 MIXED AIR CASING**

- A. Dampers: Provide manual outside and return air dampers for fixed outside air quantity.
- B. Gaskets: Provide tight fitting dampers with edge gaskets.

## **2.08 OPERATING CONTROLS**

- A. Provide low voltage, adjustable room thermostat to control burner operation, compressor and condenser fan, and supply fan to maintain temperature setting.
  - 1. Include system selector switch (heat-off-cool) and fan control switch (auto-on).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

### **3.03 SYSTEM STARTUP**

- A. Prepare and start equipment. Adjust for proper operation.

### **3.04 MAINTENANCE**

- A. Provide service and maintenance of packaged roof top units for one year year from Date of Substantial Completion.
- B. Provide routine maintenance service with a two month interval as maximum time period between calls.
- C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.
- D. After each service call, submit copy of service call work order or report that includes description of work performed.

**END OF SECTION**

**SECTION 23 8113  
PACKAGED TERMINAL AIR-CONDITIONERS**

**<<<< UPDATE NOTES**

**PART 2 PRODUCTS**

**2.01 AIR CONDITIONING UNITS**

- A. Description: Packaged, self-contained, factory assembled, prewired unit, consisting of cabinet, compressor, condensing coil, evaporator fan, evaporator coil, discharge plenum, outside air connection, heating coil, air filters, and controls; fully charged with refrigerant and filled with oil.
- B. Assembly: Up flow air delivery, in draw-through configuration as indicated.
- C. Energy Efficiency:

**2.02 CABINET**

- A. Frame and Panels: Galvanized steel with baked enamel finish, easily removed access doors or panels with quick fasteners.
- B. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.
- C. Drain Pan: Galvanized steel with corrosion-resistant coating.

**2.03 EVAPORATOR FAN**

**2.04 COMPRESSOR**

- A. Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication and internal motor protection.

**2.05 EVAPORATOR COIL**

- A. Direct expansion coiling coil of seamless copper or aluminum tubes expanded into aluminum fins.
- B. Refrigeration circuit with externally equalized thermal expansion valve, filter-drier, and charging valves.

**2.06 CONDENSER**

- A. Co-Axial: Copper tube in copper tube or shell and tube with finned copper tubes in steel shell with water temperature actuated water regulating valve.
- B. Fan: Double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, with permanently lubricated bearings.
- C. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

**2.07 HEATING COIL**

**2.08 AIR FILTERS**

**2.09 CONTROLS**

- A. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.

**END OF SECTION**

**SECTION 23 8200  
CONVECTION HEATING AND COOLING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electric cabinet unit heaters.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project procedural and administrative requirements.
- B. Division 03 - Concrete: Concrete equipment pads.
- C. Section 23 0005 - Basic HVAC Requirements
- D. Section 23 0716 - HVAC Equipment Insulation.
- E. Section 23 0719 - HVAC Piping Insulation.
- F. Section 23 2113 - Hydronic Piping.
- G. Section 23 2300 - Refrigerant Piping.
- H. Section 23 3100 - HVAC Ducts and Casings.

**1.03 REFERENCE STANDARDS**

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.
- B. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2016.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

**1.04 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Shop Drawings:
  - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
  - 2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
  - 3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- D. Manufacturer's Instructions: Indicate installation instructions and recommendations.
- E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

**PART 2 PRODUCTS**

**2.01 ELECTRIC CABINET UNIT HEATERS**

- A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

- B. Heating Elements: Provide open-wire or resistance wire enclosed in steel sheath.
- C. Cabinet: Minimum 18 gage, 0.0478 inch thick steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet, and inlet grilles.
- D. Finish:
  - 1. Factory applied, painted finish.
  - 2. Color: As selected from color chart.
- E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- F. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.
- G. Controls:
- H. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces are suitable for installation.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's recommendations.
- B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
- C. Do not damage equipment or finishes.
- D. Cabinet Unit Heaters:
  - 1. Coordinate to ensure correct recess size for recessed units.

#### **3.03 FIELD QUALITY CONTROL**

- A. Refer to Division 01 - General Requirements for additional requirements.

#### **3.04 CLEANING**

- A. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.
- B. Install new filters.

#### **3.05 PROTECTION**

- A. Provide finished cabinet units with protective covers during the balance of construction.

**END OF SECTION**

**SECTION 26 0005**  
**BASIC ELECTRICAL REQUIREMENTS**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. This section applies to all sections of Division 26 and Division 28.
- B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.
- C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.

**1.02 DRAWINGS**

- A. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

**1.03 INSPECTION OF SITE**

- A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

**1.04 TEMPORARY FACILITIES**

- A. Provide and remove upon completion of the project, in accordance with the general conditions, a complete temporary electrical and telephone service during construction.

**1.05 ALTERNATES**

- A. Refer to Division 01 - General Requirements for procedures.

**1.06 GUARANTEE**

- A. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, unless noted otherwise, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

**1.07 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 26 shall be the latest issue, unless otherwise noted.
- B. Rules of local utility companies shall be complied with. Check with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items in proposal.

- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

#### **1.08 STANDARDS OF MATERIAL AND WORKMANSHIP:**

- A. All materials shall be new, unless noted otherwise. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable standard specifications of the following recognized authorities:
  - 1. A.N.S.I. - American National Standards Institute
  - 2. A.S.T.M. - American Society for Testing Materials
  - 3. I.C.E.A. - Insulated Cable Engineers Association
  - 4. I.E.E.E. - Institute of Electrical and Electronics Engineers
  - 5. N.E.C. - National Electrical Code (NFPA 70)
  - 6. N.E.C.A. - National Electrical Contractors Association
  - 7. N.E.M.A. - National Electrical Manufacturer's Association
  - 8. N.F.P.A. - National Fire Protection Association
  - 9. U.L. - Underwriters Laboratories, Inc.
- B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
- C. All equipment of the same or similar systems shall be by the same manufacturer.

#### **1.09 RECORD DRAWINGS**

- A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.
- B. Contractor shall provide the following record drawings as part of the Project closeout document process:
  - 1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
  - 2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

#### **1.10 SUBMITTALS**

- A. Refer to Division 01 - General Requirements for procedures.
- B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (light fixtures, wiring devices, etc.). Refer to other sections of the electrical specifications for additional requirements.
- C. Engineer WILL NOT REVIEW:
  - 1. Submittals not specified.
  - 2. Submittals which do not indicate optional equipment being provided.
  - 3. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.
  - 4. Submittals made after work is delivered to site and/or installed.
  - 5. Submittal resubmissions unless resubmission is required by Architect/Engineer.

#### **1.11 MANUFACTURERS LISTED**

- A. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
- B. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer five (5) days prior to bid date.

#### **1.12 USE OF EQUIPMENT**

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.

- B. Do not use Owner's light fixtures for temporary lighting except as allowed and directed by the Owner.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 INSTALLATION OF EQUIPMENT**

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect/Engineer for resolution.
- B. Equipment location shall be as close as practical to locations shown on the drawings.
- C. Working clearances shall not be less than specified in NFPA 70 (National Electric Code).

### **3.02 COORDINATION**

- A. Install work to avoid interference with work of other trades including, but not limited to, architectural and mechanical trades. Remove and relocate any work that causes an interference at Contractor's expense. Disputes regarding the cause of an interference will be resolved by the Construction Manager or Architect/Engineer.

### **3.03 CUTTING, PATCHING AND DAMAGE TO OTHER WORK**

- A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.
- B. All cutting, patching and repair work shall be performed by the contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

### **3.04 EXCAVATION AND BACKFILLING**

- A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 30" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical drawings.
- C. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- D. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling. Tamp, roll as required.

### **3.05 EQUIPMENT FOUNDATION AND SUPPORTS**

- A. Shall be as required or as shown on plans or specified.
- B. Provide concrete house keeping bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment. Coordinate requirements with Division 03 - Concrete.
- C. For equipment suspended from ceilings or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required.

### **3.06 EQUIPMENT CONNECTIONS**

- A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the drawings, but called out by the equipment manufacturer's shop drawings shall be provided.

### **3.07 ACCESS DOORS AND PANELS**

- A. Refer to Division 08 - Openings; Provide access doors in locations as required per N.E.C. Coordinate locations with architectural trades.

### **3.08 CLEANING**

- A. Refer to Division 01 - General Requirements; All equipment shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

### **3.09 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS**

- A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.
- B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.

### **3.10 DRAWINGS AND MEASUREMENTS**

- A. Electrical drawings are not intended to be scaled for rough-in measurements nor to serve as submittals. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor.

**END OF SECTION**



**SECTION 26 0519**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Oxide inhibiting compound.
- G. Wire pulling lubricant.
- H. Cable ties.
- I. Firestop sleeves.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Section 07 8400 - Firestopping.
- D. Section 26 0005 - Basic Electrical Requirements.
- E. Section 26 0505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- F. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- G. Section 26 0536 - Cable Trays for Electrical Systems: Additional installation requirements for cables installed in cable tray systems.
- H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- J. Division 31 - Earthwork: Excavating, bedding, and backfilling.

**1.03 REFERENCE STANDARDS**

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC) 2012.
- G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2009.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- K. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.

- L. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- M. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- N. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- O. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.07 FIELD CONDITIONS**

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

### **PART 2 PRODUCTS**

#### **2.01 CONDUCTOR AND CABLE APPLICATIONS**

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      - 1) Maximum Length: 6 feet.
    - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
- H. Manufactured wiring systems are not permitted.

#### **2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- H. Minimum Conductor Size:
  - 1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
- I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- J. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.
  - 3. Color Code:
    - a. 480Y/277 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
      - 4) Neutral/Grounded: Gray.
    - b. 208Y/120 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Neutral/Grounded: White.
    - c. Equipment Ground, All Systems: Green.
    - d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

## **2.03 SINGLE CONDUCTOR BUILDING WIRE**

- A. Manufacturers:
  - 1. Copper Building Wire:
    - a. Cerro Wire LLC: [www.cerrowire.com](http://www.cerrowire.com).
    - b. Encore Wire Corporation: [www.encorewire.com](http://www.encorewire.com).
    - c. General Cable Technologies Corporation: [www.generalcable.com](http://www.generalcable.com).
    - d. Southwire Company: [www.southwire.com](http://www.southwire.com).
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  - 1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Stranded.
    - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

## **2.04 METAL-CLAD CABLE**

- A. Manufacturers:
  - 1. AFC Cable Systems Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
  - 3. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
  - 1. Size 10 AWG and Smaller: Stranded.
  - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide oversized neutral conductors where indicated or required.
- G. Grounding: Full-size integral equipment grounding conductor.
- H. Armor: Steel, interlocked tape.

## **2.05 WIRING CONNECTORS**

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### 3.03 INSTALLATION

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated without specific routing, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
  - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
  - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
  - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
  - 9. Provide oversized neutral/grounded conductors where indicated and as specified below.
    - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
    - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  - 2. Pull all conductors and cables together into raceway at same time.
  - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- H. Terminate cables using suitable fittings.
  - 1. Metal-Clad Cable (Type MC):
    - a. Use listed fittings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 12 inches of slack at each outlet.
- J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- M. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  3. Do not remove conductor strands to facilitate insertion into connector.
  4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
  5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- O. Insulate ends of spare conductors using vinyl insulating electrical tape.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

#### **3.04 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- C. Correct deficiencies and replace damaged or defective conductors and cables.

#### **END OF SECTION**

**SECTION 26 0526  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.
- C. Section 26 0005 - Basic Electrical Requirements
- D. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- E. Section 26 0536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.
- H. Division 31 - Earthwork: Excavating, trenching and fill.

**1.03 REFERENCE STANDARDS**

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  - 3. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

**1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Project Record Documents: Record actual locations of grounding electrode system components and connections.

**PART 2 PRODUCTS**

**2.01 GROUNDING AND BONDING REQUIREMENTS**

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
  - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
    - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
    - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
  - 3. Concrete-Encased Electrode:
    - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
  - 4. Ground Ring:
    - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
    - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
    - c. Provide ground enhancement material around conductor.
    - d. Provide connection from ground ring conductor to:
      - 1) Perimeter columns of metal building frame.
      - 2) Ground rod electrodes located as indicated.
  - 5. Ground Rod Electrode(s):
    - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
    - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
    - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.



6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
  - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
  - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
  - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- G. Bonding and Equipment Grounding:
  1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
- H. Cable Tray Systems: Also comply with Section 26 0536.
- I. Pole-Mounted Luminaires: Also comply with Section 26 5600.

## **2.02 GROUNDING AND BONDING COMPONENTS**

- A. General Requirements:
  1. Provide products listed, classified, and labeled as suitable for the purpose intended.
  2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
  1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      - 1) Use bare copper conductors where installed underground in direct contact with earth.
      - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
  1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
  3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
  4. Manufacturers - Mechanical and Compression Connectors:
    - a. Advanced Lightning Technology (ALT): [www.altfab.com](http://www.altfab.com)
    - b. Burndy LLC: [www.burndy.com](http://www.burndy.com)
    - c. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com)
    - d. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com)
  5. Manufacturers - Exothermic Welded Connections:
    - a. Burndy LLC: [www.burndy.com](http://www.burndy.com)
    - b. Cadweld, a brand of Erico International Corporation: [www.erico.com](http://www.erico.com)

- c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC:  
www.thermoweld.com
- D. Ground Bars:
  - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
  - 2. Size: As indicated.
  - 3. Holes for Connections: As indicated or as required for connections to be made.
  - 4. Manufacturers:
    - a. Advanced Lightning Technology (ALT): www.altfab.com
    - b. Erico International Corporation: www.erico.com
    - c. Harger Lightning & Grounding: www.harger.com
    - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC:  
www.thermoweld.com
- E. Ground Rod Electrodes:
  - 1. Comply with NEMA GR 1.
  - 2. Material: Copper-bonded (copper-clad) steel.
  - 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
  - 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
  - 5. Manufacturers:
    - a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
    - b. Erico International Corporation: www.erico.com/#sle.
    - c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
    - d. Harger Lightning & Grounding: www.harger.com/#sle.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.

### **3.03 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

**END OF SECTION**

**SECTION 26 0529  
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, and cutting and patching requirements.
- C. Division 03 - Concrete: Concrete equipment pads.
- D. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- E. Section 26 0005 - Basic Electrical Requirements
- F. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- G. Section 26 0536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.
- H. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- I. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- J. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

**1.03 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

**1.05 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

## **PART 2 PRODUCTS**

### **2.01 SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
  - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
  - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
  - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
  - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
  - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
  - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  - 2. Conduit Clamps: Bolted type unless otherwise indicated.
  - 3. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com)
    - b. Erico International Corporation: [www.erico.com](http://www.erico.com)
    - c. HoldRite, a brand of Reliance Worldwide Corporation: [www.holdrite.com](http://www.holdrite.com)
    - d. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com)
    - e. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com)
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
  - 1. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
    - c. HoldRite, a brand of Reliance Worldwide Corporation: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
    - d. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - e. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
  - 1. Comply with MFMA-4.
  - 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
  - 3. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com)
    - b. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com)
    - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com](http://www.unistrut.com)
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
  - 1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2 inch diameter.
    - b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
    - c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
    - d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
    - e. Outlet Boxes: 1/4 inch diameter.

- f. Luminaires: 1/4 inch diameter.
- F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
  - 1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
  - 3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
  - 4. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com)
    - b. Erico International Corporation: [www.erico.com](http://www.erico.com)
    - c. PHP Systems/Design: [www.phpsd.com](http://www.phpsd.com)
    - d. Unistrut, a brand of Atkore International Inc: [www.unistrut.com](http://www.unistrut.com)
- G. Anchors and Fasteners:
  - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
  - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Conduit Support and Attachment: Also comply with Section 26 0533.13.
- I. Cable Tray Support and Attachment: Also comply with Section 26 0536.
- J. Box Support and Attachment: Also comply with Section 26 0533.16.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

### **3.02 FIELD QUALITY CONTROL**

- A. See Division 01 - General Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

**SECTION 26 0533.13  
CONDUIT FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Flexible metal conduit (FMC).
- D. Electrical metallic tubing (EMT).
- E. Rigid polyvinyl chloride (PVC) conduit.
- F. Conduit fittings.
- G. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Division 07 - Thermal and Moisture Protection: Firestopping.
- D. Section 07 8400 - Firestopping.
- E. Section 26 0005 - Basic Electrical Requirements
- F. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
- G. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- H. Section 26 0529 - Hangers and Supports for Electrical Systems.
- I. Section 26 0533.16 - Boxes for Electrical Systems.
- J. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- K. Section 28 4600 - Fire Detection and Alarm: Fire alarm wiring in conduit.
- L. Division 31 - Earthwork: Excavating, trenching and fill.
- M. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

**1.03 REFERENCE STANDARDS**

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2015.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2015.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A) 2015.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.
- F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.
- G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit 2018.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2016.
- L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.



- N. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- O. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.
- P. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- R. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

## **PART 2 PRODUCTS**

### **2.01 CONDUIT APPLICATIONS**

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
  - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.
  - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
  - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
  - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
- D. Embedded Within Concrete:
  - 1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.
  - 2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.
- M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit, aluminum rigid metal conduit, or reinforced thermosetting resin conduit (RTRC).
  - 1. Corrosive locations include, but are not limited to:
    - a. Pool Equipment Room.
- N. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
  - 1. Maximum Length: 6 feet.
- O. Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit.

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Vibrating equipment includes, but is not limited to:
  - a. Transformers.
  - b. Motors.

P. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

## **2.02 CONDUIT REQUIREMENTS**

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
  1. Branch Circuits: 3/4 inch (21 mm) trade size.
  2. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
  3. Underground, Interior: 1 inch (27 mm) trade size.
  4. Underground, Exterior: 1 inch (27 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## **2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**

- A. Manufacturers:
  1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com)
  2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com)
  3. Wheatland Tube, a Division of Zekelman Industries: [www.wheatland.com](http://www.wheatland.com)
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
  1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Material: Use steel or malleable iron.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## **2.04 ALUMINUM RIGID METAL CONDUIT (RMC)**

- A. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- B. Fittings:
  1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Material: Use aluminum.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## **2.05 FLEXIBLE METAL CONDUIT (FMC)**

- A. Manufacturers:
  1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com)
  2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com)
  3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com)
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
  1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Material: Use steel or malleable iron.

## **2.06 ELECTRICAL METALLIC TUBING (EMT)**

- A. Manufacturers:
  - 1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com)
  - 2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com)
  - 3. Wheatland Tube, a Division of Zekelman Industries: [www.wheatland.com](http://www.wheatland.com)
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.
  - 3. Connectors and Couplings: Use compression (gland) or set-screw type.
    - a. Do not use indenter type connectors and couplings.
  - 4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
  - 5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

## **2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT**

- A. Manufacturers:
  - 1. Cantex Inc: [www.cantexinc.com](http://www.cantexinc.com)
  - 2. Carlon, a brand of Thomas & Betts Corporation: [www.carlon.com](http://www.carlon.com)
  - 3. JM Eagle: [www.jmeagle.com](http://www.jmeagle.com)
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## **2.08 ACCESSORIES**

- A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

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

- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- F. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal all conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
  - 5. Unless otherwise approved, do not route conduits exposed:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.
  - 6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
  - 9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  - 10. Group parallel conduits in the same area together on a common rack.
- G. Conduit Support:
  - 1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  - 4. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  - 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  - 6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
  - 7. Use of wire for support of conduits is not permitted.
- H. Connections and Terminations:
  - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  - 3. Use suitable adapters where required to transition from one type of conduit to another.
  - 4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  - 5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  - 6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- I. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  4. Conceal bends for conduit risers emerging above ground.
  5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
  6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
  8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.
- J. Underground Installation:
1. Provide trenching and backfilling in accordance with Division 31.
- K. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Secure conduits to prevent floating or movement during pouring of concrete.
- L. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Division 03 with minimum concrete cover of 2 inches on all sides unless otherwise indicated.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  3. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
  2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide grounding and bonding in accordance with Section 26 0526.
- P. Identify conduits in accordance with Section 26 0553.

### **3.03 PROTECTION**

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

### **END OF SECTION**

**SECTION 26 0533.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Floor boxes.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 03 - Concrete: Concrete.
- C. Division 07 - Thermal and Moisture Protection: Firestopping.
- D. Division 08 - Openings: Access Doors.
- E. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- F. Section 26 0005 - Basic Electrical Requirements.
- G. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- H. Section 26 0529 - Hangers and Supports for Electrical Systems.
- I. Section 26 0533.13 - Conduit for Electrical Systems:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- J. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- K. Section 26 2726 - Wiring Devices:
  - 1. Wall plates.
  - 2. Floor box service fittings.
- L. Section 26 2813 - Fuses: Spare fuse cabinets.

**1.03 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specification for Underground Enclosure Integrity 2017.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- J. UL 508A - UL Standard for Safety Industrial Control Panels 2018.
- K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

## **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
  1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.
- C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Keys for Lockable Enclosures: Two of each different key.

## **PART 2 PRODUCTS**

### **2.01 BOXES**

- A. General Requirements:
  1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
  1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  3. Use suitable concrete type boxes where flush-mounted in concrete.
  4. Use suitable masonry type boxes where flush-mounted in masonry walls.
  5. Use raised covers suitable for the type of wall construction and device configuration where required.
  6. Use shallow boxes where required by the type of wall construction.
  7. Do not use "through-wall" boxes designed for access from both sides of wall.
  8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting

- of luminaire where required.
- 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
- 12. Wall Plates: Comply with Section 26 2726.
- 13. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com)
  - b. Hubbell Incorporated; Bell Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com)
  - c. Hubbell Incorporated; RACO Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com)
  - d. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com)
  - e. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com)
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
  - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
  - 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    - b. Back Panels: Painted steel, removable.
    - c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
- D. Floor Boxes:
  - 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
  - 2. Manufacturer: Same as manufacturer of floor box service fittings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Division 08 as required where approved by the Architect.
  - 2. Unless dimensioned, box locations indicated are approximate.
  - 3. Locate boxes as required for devices installed under other sections or by others.
  - 4. Locate boxes so that wall plates do not span different building finishes.
  - 5. Locate boxes so that wall plates do not cross masonry joints.



6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
  7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
- I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- O. Close unused box openings.
- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- Q. Provide grounding and bonding in accordance with Section 26 0526.

### **3.03 PROTECTION**

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

### **END OF SECTION**

**SECTION 26 0533.23**  
**SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface raceway systems.
- B. Wireways.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements.
- C. Section 26 0005 - Basic Electrical Requirements.
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0533.13 - Conduit for Electrical Systems.
- G. Section 26 0533.16 - Boxes for Electrical Systems.
- H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 2726 - Wiring Devices: Receptacles.

**1.03 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway 2015.
- D. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate rough-in locations of outlet boxes provided under Section 26 0533.16 and conduit provided under Section 26 0533.13 as required for installation of raceways provided under this section.
  - 3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
  - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install raceways until final surface finishes and painting are complete.
  - 2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

**1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
  - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

**PART 2 PRODUCTS**

**2.01 RACEWAY REQUIREMENTS**

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

## **2.02 SURFACE RACEWAY SYSTEMS**

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com](http://www.hubbell.com)
  - 2. MonoSystems, Inc: [www.monosystems.com](http://www.monosystems.com)
  - 3. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us)

## **2.03 WIREWAYS**

- A. Manufacturers:
  - 1. Cooper B-Line, a division of Cooper Industries: [www.cooperindustries.com](http://www.cooperindustries.com)
  - 2. Enduro Composites: [www.endurocomposites.com](http://www.endurocomposites.com)
  - 3. Hoffman, a brand of Pentair Technical Products: [www.hoffmanonline.com](http://www.hoffmanonline.com)
  - 4. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us)
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
- D. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Surface Nonmetallic Raceways: Install in accordance with NEMA PRP 5.
- D. Install raceways plumb and level.
- E. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- F. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.
- G. Close unused raceway openings.
- H. Provide grounding and bonding in accordance with Section 26 0526.

## **END OF SECTION**

**SECTION 26 0553**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 09 - Finishes: Interior and Exterior Painting.
- C. Section 09 9113 - Exterior Painting.
- D. Section 09 9123 - Interior Painting.
- E. Section 26 0005 - Basic Electrical Requirements
- F. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- G. Section 26 0536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- H. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.
- I. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

**1.03 REFERENCE STANDARDS**

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

**1.04 FIELD CONDITIONS**

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

**PART 2 PRODUCTS**

**2.01 IDENTIFICATION REQUIREMENTS**

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Panelboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      - 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    - b. Transformers:
      - 1) Identify kVA rating.

- 2) Identify voltage and phase for primary and secondary.
  - 3) Identify power source and circuit number. Include location when not within sight of equipment.
- c. Enclosed switches, circuit breakers, and motor controllers:
  - 1) Identify voltage and phase.
  - 2) Identify power source and circuit number. Include location when not within sight of equipment.
  - 3) Identify load(s) served. Include location when not within sight of equipment.
- d. Transfer Switches:
  - 1) Identify voltage and phase.
  - 2) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
2. Service Equipment:
  - a. Use identification nameplate to identify each service disconnecting means.
3. Emergency System Equipment:
  - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
  - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
6. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
  - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 9123 and 09 9113.
7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
  - a. Service equipment.
  - b. Industrial control panels.
  - c. Motor control centers.
  - d. Elevator control panels.
  - e. Industrial machinery.
8. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.
- C. Identification for Conductors and Cables:
  1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
  2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- D. Identification for Cable Tray: Comply with Section 26 0536.
- E. Identification for Boxes:
  1. Use voltage markers to identify highest voltage present.
  2. Use voltage markers or color coded boxes to identify systems other than normal power system.
    - a. Color-Coded Boxes: Field-painted in accordance with Division 09 per the same color code used for raceways.
- F. Identification for Devices:
  1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
  2. Use identification label to identify fire alarm system devices.
    - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
  3. Use identification label to identify serving branch circuit for all receptacles.
    - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

- G. Identification for Luminaires:
  - 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

## **2.02 IDENTIFICATION NAMEPLATES AND LABELS**

- A. Identification Nameplates:
  - 1. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
  - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
  - 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
  - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Caution and Warning Messages:
  - 1. Minimum Size: 2 inches by 4 inches.
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 1/2 inch.
  - 5. Color: Black text on yellow background unless otherwise indicated.
- D. Format for Receptacle Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Power source and circuit number or other designation indicated.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Black text on clear background.
- E. Format for Fire Alarm Device Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Designation indicated and device zone or address.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Red text on white background.

## **2.03 VOLTAGE MARKERS**

- A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- B. Minimum Size:
  - 1. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  - 2. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- C. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
  - 2. Markers for System Identification:
    - a. Emergency Power System: Text "EMERGENCY".
- D. Color: Black text on orange background unless otherwise indicated.

## **2.04 UNDERGROUND WARNING TAPE**

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:
  - 1. Tape for Buried Power Lines: Black text on red background.
  - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

## **2.05 FLOOR MARKING TAPE**

- A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

## **2.06 WARNING SIGNS AND LABELS**

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
  - 1. Materials:
    - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
    - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
  - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
  - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
  - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
  - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Inside of equipment door.
  - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Boxes: Outside face of cover.
  - 8. Conductors and Cables: Legible from the point of access.
  - 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

**END OF SECTION**



**SECTION 26 0573  
POWER SYSTEM STUDIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
  - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Section 26 0005 - Basic Electrical Requirements.
- C. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- D. Section 26 2416 - Panelboards.
- E. Section 26 2813 - Fuses.
- F. Section 26 2816.16 - Enclosed Switches.

**1.03 REFERENCE STANDARDS**

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011.
- B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators 2018.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace 2018.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
  - 2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Submit study reports prior to or concurrent with product submittals.
  - 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

**1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Study reports, stamped or sealed and signed by study preparer.
- C. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
  - 1. Identify modifications made in accordance with studies that:
    - a. Can be made at no additional cost to Owner.
    - b. As submitted will involve a change to the contract sum.

## **1.06 POWER SYSTEM STUDIES**

- A. Scope of Studies:
  - 1. Perform analysis of new electrical distribution system as indicated on drawings.
  - 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
  - 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
- B. General Study Requirements:
  - 1. Comply with NFPA 70.
  - 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
  - 1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
      - 1) Obtain up-to-date information from Utility Company.
    - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
    - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    - e. Protective Devices:
      - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
      - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
    - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
  - 1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
  - 2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    - a. Maximum utility fault currents.
    - b. Maximum motor contribution.
    - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
  2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
  3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    - a. Maximum and minimum utility fault currents.
    - b. Maximum and minimum motor contribution.
    - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- F. Study Reports:
1. General Requirements:
    - a. Identify date of study and study preparer.
    - b. Identify study methodology and software product(s) used.
    - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
    - d. Identify base used for per unit values.
    - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
    - f. Include conclusions and recommendations.
  2. Short-Circuit Study:
    - a. For each scenario, identify at each bus location:
      - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      - 2) Fault point X/R ratio.
      - 3) Associated equipment short circuit current ratings.
    - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
  3. Arc Flash and Shock Risk Assessment:
    - a. For the worst case for each scenario, identify at each bus location:
      - 1) Calculated incident energy and associated working distance.
      - 2) Calculated arc flash boundary.
      - 3) Bolted fault current.
      - 4) Arcing fault current.
      - 5) Clearing time.
      - 6) Arc gap distance.
    - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

## **1.07 QUALITY ASSURANCE**

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
- B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

## **PART 2 PRODUCTS**

### **2.01 ARC FLASH HAZARD WARNING LABELS**

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
  1. Materials: Comply with Section 26 0553.
  2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    - a. Include the following information:
      - 1) Arc flash boundary.

- 2) Available incident energy and corresponding working distance.
- 3) Nominal system voltage.
- 4) Equipment identification.
- 5) Date calculations were performed.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install arc flash warning labels in accordance with Section 26 0553.

#### **3.02 FIELD QUALITY CONTROL**

- A. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Adjust equipment and protective devices for compliance with studies and recommended settings.
- D. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from studies. Obtain direction before proceeding.

**END OF SECTION**

**SECTION 26 0935  
DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Distributed Digital Lighting Control System
- B. Digital Load Controllers (Room and Fixture Controllers)
- C. Digital Wall or Ceiling Mounted Occupancy Sensor
- D. Digital Wall Switch Occupancy Sensors
- E. Digital Wall Switches

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Section 26 0005 - Basic Electrical Requirements.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0533.13 - Conduit for Electrical Systems.
- E. Section 26 0533.16 - Boxes for Electrical Systems.
- F. Section 26 0553 - Identification for Electrical Systems.
- G. Section 26 2726 - Wiring Devices.
- H. Section 26 3323 - Central Battery Equipment and Inverters.
- I. Section 26 5100 - Interior Lighting.
- J. Section 26 5600 - Exterior Lighting.

**1.03 REFERENCE STANDARDS**

- A. FCC Article 15, Section J, Class A.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NEMA WD 7 - Occupancy Motion Sensors Standard; Current Edition.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- E. NFPA 70 - National Electrical Code; Most recent edition adopted by Authority Having Jurisdiction, including all applicable Amendments and Supplements.
- F. UL 508 - Standard for Industrial Control Equipment; Current Edition, including all Revisions.
- G. UL 916 - Standard for Energy Management Equipment; Current Edition, including all Revisions.
- H. UL 924 - Standard for Emergency Lighting and Power Equipment
- I. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

**1.04 DESIGN / PERFORMANCE REQUIREMENTS**

- A. Digital lighting control system shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

**1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Catalog sheets and specifications.
  - 2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

3. Storage and handling requirements and recommendations.
  4. Installation instructions.
- C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
  2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
  3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
  4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Closeout Submittals:
1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
  2. Operation and Maintenance Manual:
    - a. Include approved Shop Drawings and Product Data.
    - b. Include Sequence of Operation, identifying operation for each room or space.
    - c. Include manufacturer's maintenance information.
    - d. Operation and Maintenance Data: Include detailed information on device programming and setup.
    - e. Include startup and test reports.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.
- C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

#### **1.07 PRE-INSTALLATION MEETINGS**

- A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
  1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
  2. Review the specifications for low voltage control wiring and termination.
  3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
  4. Discuss requirements for integration with other trades
- C. Inspect and make notes of job conditions prior to installation:
  1. Record minutes of the conference and provide copies to all parties present.
  2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
  3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

#### **1.08 PROJECT CONDITIONS**

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

- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
  - 1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
  - 2. Relative humidity: Maximum 90 percent, non-condensing.

## **1.09 WARRANTY**

- A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturers:
  - 1. Lutron
  - 2. Wattstopper (Legrand)
  - 3. Eaton Greengate
  - 4. nLight (Acuity Brands)
  - 5. Crestron
  - 6. Leviton
  - 7. Enlighted (Siemens)
  - 8. Engineer pre-approved equal.

### **2.02 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM**

- A. System General: Provide digital lighting control system complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing, this specification, contact the Engineer for clarification prior to proceeding.
  - 1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
  - 2. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
    - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
    - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
    - c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
    - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
  - 3. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.
- B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
  - 1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system for power and data to room devices.
  - 2. Digital Fixture Controllers: Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.

3. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
  4. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
  5. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
- C. Local Network: Digital lighting control local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
1. Features of the digital lighting control local network include:
    - a. Automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
    - b. Simple replacement of any device in the local digital lighting control network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
    - c. Ability to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
    - d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
  2. Digital room devices connect to the local network using pre-terminated low voltage cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
  3. If manufacturer's pre-terminated low voltage cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

### **2.03 DIGITAL LOAD CONTROLLERS (ROOM AND FIXTURE CONTROLLERS)**

- A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard applications. Control units include the following features
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
  2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
  3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
  4. Device Status LEDs to indicate:
    - a. Data transmission
    - b. Device has power
    - c. Status for each load
    - d. Configuration status
  5. Quick installation features including:
    - a. Standard junction box mounting
    - b. Quick low voltage connections using standard RJ-45 patch cable
  6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
    - a. Turn on to 100 percent
    - b. Turn off



- c. Turn on to last level
  - 7. Each load be configurable to operate in the following sequences based on occupancy:
    - a. Auto-on/Auto-off (Follow on and off)
    - b. Manual-on/Auto-off (Follow off only)
  - 8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
  - 9. BACnet object information shall be available for the following objects:
    - a. Load status
    - b. Schedule state, normal or after-hours
    - c. Demand Response enable and disable
    - d. Room occupancy status
    - e. Total room lighting and plug loads watts
    - f. Electrical current
    - g. Total watts per controller
    - h. Total room watts/sq ft.
    - i. Force on/off all loads
  - 10. UL 2043 plenum rated
  - 11. Manual override and LED indication for each load
  - 12. Zero cross circuitry for each load
  - 13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
  - 14. Dimming Room Controllers shall share the following features:
    - a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    - b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    - c. The following dimming attributes may be changed or selected using a wireless configuration tool:
      - 1) Establish preset level for each load from 0-100 percent
      - 2) Set high and low trim for each load
      - 3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
    - d. Override button for each load provides the following functions:
      - 1) Press and release for on/off control
      - 2) Press and hold for dimming control
    - e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
    - f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
    - g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
    - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
- B. Fixture Controllers shall include
- 1. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
  - 2. One 3A 120/277V rated mechanically held relay.
  - 3. Programmable behavior on power up following the loss of normal power:
    - a. Turn on to 100 percent
    - b. Turn off
    - c. Turn on to last level

4. Requirement for 7 mA of 24VDC operating power from the digital lighting control local network.
5. Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the digital lighting control local network to drive accessory devices.
6. Power to drive the fixture controller electronics can come from any room controller
7. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.
8. Connect to a single or dual RJ-45 adaptor with 24 inch leads. Single adaptor mounts in a 1/2 inch KO and dual adaptor in a 2.2 by 1.32 inch rectangular hole for connection to the digital lighting control local network.
9. Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
10. A complete set of dimming features described above in the paragraph detailing On/Off/Dimming Enhanced Room Controllers.

## **2.04 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR**

- A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
  1. Digital calibration and pushbutton configuration for the following variables:
    - a. Sensitivity, 0-100 percent in 10 percent increments
    - b. Time delay, 1-0 minutes in 1 minute increments
    - c. Test mode, Five second time delay
    - d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - e. Walk-through mode
  2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the digital lighting control local network.
  3. Programmable control functionality including:
    - a. Each sensor may be programmed to control specific loads within a local network.
    - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
    - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      - e. Ultrasonic and Passive Infrared
      - f. Ultrasonic or Passive Infrared
      - g. Ultrasonic only
      - h. Passive Infrared only
      - i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
  4. One or two RJ-45 port(s) for connection to digital lighting control local network.
  5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
  6. Device Status LEDs, which may be disabled for selected applications, including:
    - a. PIR detection
    - b. Ultrasonic detection
    - c. Configuration mode
    - d. Load binding
  7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
  8. Manual override of controlled loads.
  9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an

expected life of no less than 10 years.

- B. BACnet object information shall be available for the following objects:
  - 1. Detection state
  - 2. Occupancy sensor time delay
  - 3. Occupancy sensor sensitivity, PIR and Ultrasonic
- C. Units shall not have any dip switches or potentiometers for field settings
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration will be required.

## **2.05 DIGITAL WALL SWITCH OCCUPANCY SENSORS**

- A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
  - 1. Digital calibration and pushbutton configuration for the following variables:
    - a. Sensitivity: 0-100 percent in 10 percent increments
    - b. Time delay: 1-30 minutes in 1 minute increments
    - c. Test mode: Five second time delay
    - d. Detection technology: PIR, Dual Technology activation and/or re-activation.
    - e. Walk-through mode
    - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the digital lighting control local network.
  - 2. Programmable control functionality including:
    - a. Each sensor may be programmed to control specific loads within a local network.
    - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
    - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      - 1) Ultrasonic and Passive Infrared
      - 2) Ultrasonic or Passive Infrared
      - 3) Ultrasonic only
      - 4) Passive Infrared only
  - 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
  - 4. Two RJ-45 ports for connection to digital lighting control local network.
  - 5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
  - 6. Device Status LEDs including
    - a. PIR detection
    - b. Ultrasonic detection
    - c. Configuration mode
    - d. Load binding
  - 7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
  - 8. Assignment of local buttons to specific loads within the room without wiring or special tools
  - 9. Manual override of controlled loads
  - 10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
  - 1. Detection state
  - 2. Occupancy sensor time delay
  - 3. Occupancy sensor sensitivity, PIR and Ultrasonic

4. Button state
  5. Switch lock control
  6. Switch lock status
- C. Units shall not have any dip switches or potentiometers for field settings.
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration will be required.
- E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
1. Left button
    - a. Press and release - Turn load on
    - b. Press and hold - Raise dimming load
  2. Right button
    - a. Press and release - Turn load off
    - b. Press and hold - Lower dimming load
- F. Low voltage momentary pushbuttons shall include the following features:
1. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
  2. The following button attributes may be changed or selected using a wireless configuration tool:
    - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
    - b. Individual button function may be configured to Toggle, On only or Off only.
    - c. Individual scenes may be locked to prevent unauthorized change.
    - d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
    - e. Ramp rate may be adjusted for each dimmer switch.
    - f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

## 2.06 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 6 button configuration. Wall switches shall include the following features:
1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
  2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  3. Configuration LED on each switch that blinks to indicate data transmission.
  4. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
    - d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
  5. Programmable control functionality including:
    - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
    - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
  6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
1. Button state

2. Switch lock control
  3. Switch lock status
- C. Two RJ-45 ports for connection to digital lighting control local network.
  - D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology digital lighting control local network. No additional configuration shall be required to achieve multi-way switching.
  - E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
    1. Individual button function may be configured to Toggle, On only or Off only.
    2. Individual scenes may be locked to prevent unauthorized change.
    3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
    4. Ramp rate may be adjusted for each dimmer switch.
    5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

### **3.02 INSTALLATION**

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. All wiring associated with the specified controls system shall be installed within conduit or conduits unless otherwise indicated on the Drawings. Refer to 26 0533.13 - Conduit for Electrical Systems for requirements.
- C. Install all room/area devices using manufacturer's factory-tested low voltage cable with pre-terminated RJ-45 connectors.
  1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
  2. If fixtures have internal digital lighting control Control Modules, ensure that they are also connected with low voltage cable.
  3. Install all room to room network devices using manufacturer-supplied network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
  4. Low voltage wiring topology must comply with manufacturer's specifications.
  5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
  6. All lighting control low voltage wiring jacket colors shall be coordinated with and approved by Owner.
    - a. If there is no selection provided by Owner, jacket color shall be yellow.
- D. All line voltage connections shall be tagged to indicate circuit and switched legs.
- E. Test all devices to ensure proper communication.
- F. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- G. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
  1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters (e.g. blink warning, etc.)
- H. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
- I. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.
- J. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- K. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- L. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.
- M. Remote Access for Network Systems: If "REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS" is specified in Part 1 of this specification, ensure Segment Manager enclosure is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, and mount magnetic antenna for the modem. For cases where alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify final mounting location with Engineer and Owner prior to proceeding with the Work.

### **3.03 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Engineer and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
  1. Verify Class I and II wiring connections are terminated properly by validating system performance.
  2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
  3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
  4. Verify that the control of each space complies with the Sequence of Operation.
  5. Correct any system issues and re-test.
- C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
  1. Date of test or inspection.
  2. Loads per space, or Fixture Address identification.
  3. Quantity and Type of each device installed
  4. Reports providing each device's settings.

### **3.04 DEMONSTRATION AND TRAINING**

- A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
  1. Confirmation of entire system operation and communication to each device.
  2. Confirmation of operation of individual relays, switches, and sensors.
  3. Confirmation of system Programming, photocell settings, override settings, etc.
  4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

### **3.05 PRODUCT SUPPORT AND SERVICE**

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

**END OF SECTION**

## **SECTION 26 2413 SWITCHBOARDS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 03 - Concrete: Concrete equipment pads.
- C. Section 26 0005 - Basic Electrical Requirements.
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- H. Section 26 2813 - Fuses: Fuses for fusible switches.

#### **1.03 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NEMA PB 2 - Deadfront Distribution Switchboards 2011.
- G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- L. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- M. UL 891 - Switchboards Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.



5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
  2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
  3. Obtain Utility Company approval of switchboard prior to fabrication.
  4. Arrange for inspections necessary to obtain Utility Company approval of installation.

#### **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
  2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  3. Include documentation of listed series ratings as indicated in Section 26 0573.
- C. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- D. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Switchboards:
1. ABB/GE: [www.geindustrial.com](http://www.geindustrial.com)
  2. Eaton Corporation: [www.eaton.com](http://www.eaton.com)
  3. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us)
  4. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com)

#### **2.02 SWITCHBOARDS**

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Service Entrance Switchboards:

1. Listed and labeled as suitable for use as service equipment according to UL 869A.
  2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
  3. Comply with Utility Company requirements for electrical service.
  4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
- E. Switchboards With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).
- F. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude: Less than 6,600 feet.
    - b. Ambient Temperature:
      - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
  2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- G. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
  2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  4. Phase and Neutral Bus Material: Aluminum.
  5. Ground Bus Material: Aluminum.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
    - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Main and Neutral Lug Type: Mechanical.
  2. Load Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Lug Type:
      - 1) Provide mechanical lugs unless otherwise indicated.
- K. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
    - b. Outdoor Locations: Type 3R.
  2. Finish: Manufacturer's standard unless otherwise indicated.
- L. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- M. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

- N. Owner Metering:
1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
  2. Measured Parameters:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase and neutral.
    - c. Frequency (Hz).
    - d. Real power (kW): For each phase, 3-phase total.
    - e. Reactive power (kVAR): For each phase, 3-phase total.
    - f. Apparent power (kVA): For each phase, 3-phase total.
    - g. Power factor.
  3. Meter Accuracy: Plus/minus 1.0 percent.
- O. Instrument Transformers:
1. Comply with IEEE C57.13.
  2. Select suitable ratio, burden, and accuracy as required for connected devices.
  3. Current Transformers: Connect secondaries to shorting terminal blocks.
  4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

## **2.03 OVERCURRENT PROTECTIVE DEVICES**

- A. Circuit Breakers:
1. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  2. Molded Case Circuit Breakers:
    - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      - 1) Provide electronic trip circuit breakers where indicated.
    - b. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 3000.
- H. Provide grounding and bonding in accordance with Section 26 0526.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as indicated.
- L. Provide filler plates to cover unused spaces in switchboards.

### **3.02 FIELD QUALITY CONTROL**

- A. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.1.
- D. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than [ ] amperes. Tests listed as optional are not required.
- E. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- F. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- G. Correct deficiencies and replace damaged or defective switchboards or associated components.

### **3.03 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

**END OF SECTION**

## **SECTION 26 2416 PANELBOARDS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Division 03 - Concrete: Concrete equipment pads.
- D. Section 26 0005 - Basic Electrical Requirements.
- E. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- F. Section 26 0529 - Hangers and Supports for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- I. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

#### **1.03 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- K. UL 67 - Panelboards Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- N. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- O. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include documentation of listed series ratings as indicated in Section 26 0573.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. Panelboard Keys: Two of each different key.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. ABB/GE: [www.geindustrial.com](http://www.geindustrial.com)
- B. Eaton Corporation: [www.eaton.com](http://www.eaton.com)
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us)
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com)

#### **2.02 PANELBOARDS - GENERAL REQUIREMENTS**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  1. Altitude: Less than 6,600 feet.
  2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
    - b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
  1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.

- b. Outdoor Locations: Type 3R.
  - c. Pool Equipment Room: Type 4X..
- 2. Boxes: Galvanized steel unless otherwise indicated.
  - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
- 3. Fronts:
  - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
  - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
- 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- L. Load centers are not acceptable.

### **2.03 POWER DISTRIBUTION PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase and Neutral Bus Material: Aluminum.
  - 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
  - 1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
- E. Enclosures:
  - 1. Provide surface-mounted enclosures unless otherwise indicated.
  - 2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
  - 3. Provide clear plastic circuit directory holder mounted on inside of door.

### **2.04 LIGHTING AND APPLIANCE PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  - 2. Phase and Neutral Bus Material: Aluminum.
  - 3. Ground Bus Material: Aluminum.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
  - 2. Provide clear plastic circuit directory holder mounted on inside of door.

### **2.05 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
  - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
  - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
  - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
  - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26 0526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide filler plates to cover unused spaces in panelboards.

### **3.03 FIELD QUALITY CONTROL**



- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than [ ] amperes. Tests listed as optional are not required.
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test AFCI circuit breakers to verify proper operation.
- G. Correct deficiencies and replace damaged or defective panelboards or associated components.

### **3.04 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

**END OF SECTION**

## **SECTION 26 2726 WIRING DEVICES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Section 26 0005 - Basic Electrical Requirements.
- D. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- E. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- F. Section 26 0533.16 - Boxes for Electrical Systems.
- G. Section 26 0533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
- H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 0583 - Wiring Connections: Cords and plugs for equipment.
- J. Section 26 0953

#### **1.03 REFERENCE STANDARDS**

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2017h.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2017g.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interruptioners Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
  6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

## **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

## **PART 2 PRODUCTS**

### **2.01 WIRING DEVICE APPLICATIONS**

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in areas listed below:
1. All 15 and 20-ampere 125 and 250-volt nonlocking type receptacles in the areas listed below shall be listed tamper-resistant receptacles, unless otherwise excluded in NEC.
    - a. Dwelling units in all areas specified in NEC 210.52 and 550.13.
    - b. Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
1. Outlet shall be readily accessible.
- H. Provide GFCI protection for outlets serving vending machines. Outlets shall be readily accessible.

### **2.02 WIRING DEVICE FINISHES**

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with gray stainless steel wall plate.

### **2.03 WALL SWITCHES**

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

### **2.04 RECEPTACLES**

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell.com](http://www.hubbell.com)
  2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com)
  3. Lutron Electronics Company, Inc; Designer Style: [www.lutron.com](http://www.lutron.com)
  4. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us)
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
  2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
  3. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
  4. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  5. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
  6. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
    - a. Provide test and reset buttons of same color as device.
  2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
  4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
  5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
    - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
  2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

## 2.05 WALL PLATES

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com)
  2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com)
  3. Lutron Electronics Company, Inc: [www.lutron.com](http://www.lutron.com)
  4. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us)
  5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  2. Size: Standard.
  3. Screws: Metal with slotted heads finished to match wall plate finish.

- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### **3.03 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switches: 48 inches above finished floor.
    - b. Receptacles: 18 inches above finished floor or 6 inches above counter.
  - 2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  - 3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
- I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- K. Install wall switches with OFF position down.

- L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- O. Identify wiring devices in accordance with Section 26 0553.

#### **3.04 FIELD QUALITY CONTROL**

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

#### **END OF SECTION**

## **SECTION 26 2813 FUSES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Fuses.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Section 26 0005 - Basic Electrical Requirements.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.
- E. Section 26 2416 - Panelboards: Fusible switches.
- F. Section 26 2816.16 - Enclosed Switches: Fusible switches.

#### **1.03 REFERENCE STANDARDS**

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- C. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses Current Edition, Including All Revisions.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Bussmann, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com)
- B. Littelfuse, Inc: [www.littelfuse.com](http://www.littelfuse.com)
- C. Mersen: [ep-us.mersen.com](http://ep-us.mersen.com)

#### **2.02 APPLICATIONS**

- A. Service Entrance:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

#### **2.03 FUSES**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Class L Fuses: Comply with UL 248-10.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

**END OF SECTION**



## **SECTION 26 2816.16 ENCLOSED SWITCHES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Enclosed safety switches.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Section 26 0005 - Basic Electrical Requirements.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
- G. Section 26 2813 - Fuses.
- H. Section 26 3600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

#### **1.03 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. ABB/GE: [www.geindustrial.com](http://www.geindustrial.com)
- B. Eaton Corporation: [www.eaton.com](http://www.eaton.com)
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us)
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com)

## **2.02 ENCLOSED SAFETY SWITCHES**

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
  - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- H. Provide with switch blade contact position that is visible when the cover is open.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Heavy Duty Switches:
  - 1. Comply with NEMA KS 1.
  - 2. Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
    - a. Provide means for locking handle in the ON position where indicated.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Identify enclosed switches in accordance with Section 26 0553.

### **3.02 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

**END OF SECTION**

**SECTION 26 3213  
ENGINE GENERATORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Packaged engine generator system and associated components and accessories:
  - 1. Engine and engine accessory equipment.
  - 2. Alternator (generator).
  - 3. Generator set control system.
  - 4. Generator set enclosure.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 03 - Concrete: Concrete equipment pads.
- C. Division 23 - Heating, Ventilation and Air-Conditioning (HVAC): Fuel piping.
- D. Section 23 5100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
  - 1. Includes installation of exhaust silencer specified in this section.
- E. Section 26 0005 - Basic Electrical Requirements.
- F. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- G. Section 26 0529 - Hangers and Supports for Electrical Systems.
- H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

**1.03 REFERENCE STANDARDS**

- A. MDEQ - Natural Resources and Environmental Protection Act Current Edition, Including all revisions.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA/EGSA 404 - Standard for Installing Generator Sets 2014.
- D. NEMA MG 1 - Motors and Generators 2018.
- E. NFPA 30 - Flammable and Combustible Liquids Code 2018.
- F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2018.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 99 - Health Care Facilities Code 2018.
- I. NFPA 110 - Standard for Emergency and Standby Power Systems 2019.
- J. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection 2018.
- K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries Current Edition, Including All Revisions.
- L. UL 2085 - Protected Aboveground Tanks for Flammable and Combustible Liquids Current Edition, Including All Revisions.
- M. UL 2200 - Stationary Engine Generator Assemblies Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
    - a. Transfer Switches: See Section 26 3600.
  - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
  - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
  5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

#### **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
1. Include generator set sound level test data.
  2. Include characteristic trip curves for overcurrent protective devices upon request.
  3. Include alternator thermal damage curve upon request.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Derating Calculations: Indicate ratings adjusted for applicable service conditions.
- E. Manufacturer's factory emissions certification.
- F. Manufacturer's certification that products meet or exceed specified requirements.
- G. Provide NFPA 110 required documentation from manufacturer, including but not limited to:
1. Certified prototype tests.
  2. Torsional vibration compatibility certification.
  3. NFPA 110 compliance certification.
  4. Certified rated load test at rated power factor.
- H. Manufacturer's detailed field testing procedures.
- I. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- J. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- K. Maintenance contracts.
- L. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with the following:
1. NFPA 70 (National Electrical Code).
  2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
  3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
  4. NFPA 30 (Flammable and Combustible Liquids Code).
  5. UL Certified.
  6. EPA Certified.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.07 WARRANTY**

- A. Refer to Division 01 - General Requirements for additional warranty requirements.

- B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Packaged Engine Generator Set:
  - 1. Cummins Power Generation Inc: [www.cumminspower.com](http://www.cumminspower.com)
  - 2. Generac Power Systems: [www.generac.com/industrial](http://www.generac.com/industrial)
  - 3. Kohler Co: [www.kohlerpower.com](http://www.kohlerpower.com)
  - 4. MTU Onsite Energy, a Brand of Rolls-Royce Power Systems: [www.mtuonsiteenergy.com](http://www.mtuonsiteenergy.com)
- B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

### **2.02 PACKAGED ENGINE GENERATOR SYSTEM**

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
  - 1. Application: Emergency/standby.
  - 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
- D. Packaged Engine Generator Set:
  - 1. Type: Gaseous (spark ignition).
  - 2. Power Rating: As indicated on drawings, standby.
  - 3. Voltage: As indicated on drawings.
- E. Generator Set General Requirements:
  - 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
  - 2. Factory-assembled, with components mounted on suitable base.
  - 3. List and label engine generator assembly as complying with UL 2200.
  - 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
  - 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
- F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- G. Starting and Load Acceptance Requirements:
  - 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
  - 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
  - 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
  - 4. Maximum Load Step: Refer to "Generator Performance Requirements" schedule in Electrical drawings.
  - 5. Motor Starting Capability: Supports starting of motor load indicated with a maximum voltage dip as indicated under "Maximum Load Step" above.
- H. Exhaust Emissions Requirements:
  - 1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
  - 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made,

provide field emissions testing as necessary for certification.

- I. Sound Level Requirements:
  - 1. Do not exceed 72 dBA when measured at 23 feet from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.
  - 2. Comply with applicable noise level regulations.
- J. Interface with building automation system.

## **2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT**

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Gaseous (Spark Ignition):
  - 1. Fuel Source: Natural gas.
  - 2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
  - 3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:
    - a. Carburetor.
    - b. Gas pressure regulators.
    - c. Fuel shutoff control valves.
    - d. Low gas pressure switches.
- C. Engine Starting System:
  - 1. System Type: Electric, with DC solenoid-activated starting motor(s).
  - 2. Battery(s):
    - a. Battery Type: Lead-acid.
    - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
    - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
  - 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
  - 4. Battery Charger:
    - a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
    - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
    - c. Recognized as complying with UL 1236.
    - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
    - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
    - f. Provide alarm output contacts as necessary for alarm indications.
- D. Engine Speed Control System (Governor):
  - 1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
  - 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- E. Engine Lubrication System:
  - 1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
  - 2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.
- F. Engine Cooling System:

1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
  2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
  3. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.
- G. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
  2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

#### **2.04 ALTERNATOR (GENERATOR)**

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
  2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
  3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.

#### **2.05 GENERATOR SET CONTROL SYSTEM**

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
  2. Generator Set Control Functions:
    - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
    - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
    - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
    - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset. Coordinate final location with AHJ.
    - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
    - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
    - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
  3. Generator Set Status Indications:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase.
    - c. Frequency (Hz).
    - d. Real power (W/kW).
    - e. Reactive power (VAR/kVAR).
    - f. Apparent power (VA/kVA).
    - g. Power factor.
    - h. Duty Level: Actual load as percentage of rated power.



- i. Engine speed (RPM).
- j. Battery voltage (Volts DC).
- k. Engine oil pressure.
- l. Engine coolant temperature.
- m. Engine run time.
- n. Generator powering load (position signal from Fire Pump).
- 4. Generator Set Protection and Warning/Shutdown Indications:
  - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
    - 1) Overcrank (shutdown).
    - 2) Low coolant temperature (warning).
    - 3) High coolant temperature (warning).
    - 4) High coolant temperature (shutdown).
    - 5) Low oil pressure (shutdown).
    - 6) Overspeed (shutdown).
    - 7) Low fuel level (warning).
    - 8) Low coolant level (warning/shutdown).
    - 9) Generator control not in automatic mode (warning).
    - 10) High battery voltage (warning).
    - 11) Low cranking voltage (warning).
    - 12) Low battery voltage (warning).
    - 13) Battery charger failure (warning).
  - b. In addition to NFPA 110 requirements, provide the following protections/indications:
    - 1) High AC voltage (shutdown).
    - 2) Low AC voltage (shutdown).
    - 3) High frequency (shutdown).
    - 4) Low frequency (shutdown).
    - 5) Overcurrent (shutdown).
  - c. Provide contacts for local and remote common alarm.
  - d. Provide lamp test function that illuminates all indicator lamps.
- 5. Other Control Panel Features:
  - a. Event log.
  - b. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
  - c. Remote monitoring capability.
- C. Remote Annunciator:
  - 1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
  - 2. Generator Set Status Indications:
    - a. Generator powering load (via position signal from Fire Pump).
    - b. Communication functional.
  - 3. Generator Set Warning/Shutdown Indications:
    - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
      - 1) Overcrank (shutdown).
      - 2) Low coolant temperature (warning).
      - 3) High coolant temperature (warning).
      - 4) High coolant temperature (shutdown).
      - 5) Low oil pressure (shutdown).
      - 6) Overspeed (shutdown).
      - 7) Low fuel level (warning).
      - 8) Low coolant level (warning/shutdown).
      - 9) Generator control not in automatic mode (warning).
      - 10) High battery voltage (warning).
      - 11) Low cranking voltage (warning).
      - 12) Low battery voltage (warning).

- 13) Battery charger failure (warning).
  - b. Provide audible alarm with silence function.
  - c. Provide lamp test function that illuminates all indicator lamps.
- D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

## **2.06 GENERATOR SET ENCLOSURE**

- A. Enclosure Type: Sound attenuating, weather protective.
- B. Enclosure Material: Steel or aluminum.
- C. Hardware Material: Stainless steel.
- D. Color: Manufacturer's standard.
- E. Access Doors: Lockable, with all locks keyed alike.
- F. Openings: Designed to prevent bird/rodent entry.
- G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.
- H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive equipment.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized, minimum 4 inch high concrete pad constructed in accordance with Section 26 0005 and Division 03 - Concrete. Provide suitable vibration isolators, where no factory installed.
- F. Provide required support and attachment in accordance with Section 26 0529.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- H. Provide engine exhaust piping in accordance with Section 23 5100, where not factory installed.
  - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
  - 2. Do not exceed manufacturer's maximum back pressure requirements.
- I. Install exhaust silencer in accordance with Section 23 5100, where not factory installed.
- J. Provide grounding and bonding in accordance with Section 26 0526.
- K. Identify system wiring and components in accordance with Section 26 0553.

### **3.03 FIELD QUALITY CONTROL**

- A. See Division 01 - General Requirements for additional requirements.
- B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

- D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- F. Preliminary inspection and testing to include, at a minimum:
  - 1. Inspect each system component for damage and defects.
  - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
  - 3. Check for proper oil and coolant levels.
- G. Prepare and start system in accordance with manufacturer's instructions.
- H. Perform acceptance test in accordance with NFPA 110.
- I. Provide field emissions testing where necessary for certification.
- J. Sound Level Tests: Measure sound levels for compliance with specified requirements. Identify and report ambient noise conditions.
- K. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

#### **3.04 CLOSEOUT ACTIVITIES**

- A. See Division 01 - General Requirements for closeout submittals.
- B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of four hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

#### **3.05 MAINTENANCE**

- A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

**END OF SECTION**

## **SECTION 26 5100 INTERIOR LIGHTING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Ballasts and drivers.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.
- C. Section 26 0005 - Basic Electrical Requirements.
- D. Section 26 0533.13 - Conduit for Electrical Systems.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0533.16 - Boxes for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 0935 - Distributed Digital Lighting Control System: Devices for automatic control of lighting, including occupancy sensors, daylighting controls, networked control stations and motion sensors.
- I. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.
- J. Section 26 5600 - Exterior Lighting.

#### **1.03 REFERENCE STANDARDS**

- A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).
- B. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- C. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).
- D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
- E. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems 2006.
- H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.
- I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2016.
- J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- N. UL 1598 - Luminaires Current Edition, Including All Revisions.
- O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits Current Edition, Including All Revisions.

- P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
  2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
  3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
  4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70 and NFPA 101.

### **PART 2 PRODUCTS**

#### **2.01 LUMINAIRE TYPES**

- A. Furnish products as indicated in luminaire schedule included on the drawings.

#### **2.02 LUMINAIRES**

- A. Provide products that comply with requirements of NFPA 70 and NFPA 101.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s), light engines, drivers and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
  2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
  4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.
- H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

## **2.03 EMERGENCY LIGHTING UNITS**

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
  1. Sealed maintenance-free lead calcium unless otherwise indicated.
  2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

## **2.04 BALLASTS AND DRIVERS**

- A. Ballasts/Drivers - General Requirements:
  1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
  3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- B. Dimmable LED Drivers:
  1. Dimming Range: Continuous dimming from 100 percent to 10 percent relative light output unless dimming capability to lower level is indicated, without flicker.
  2. Control Compatibility: Fully compatible with the dimming controls to be installed.
- C. Dimmable LED Drivers: Comply with Section 26 0935 - Distributed Digital Lighting Control System.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- B. Verify that suitable support frames are installed where required.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
  1. Do not use ceiling tiles to bear weight of luminaires.
  2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
  4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  5. See appropriate Division 09 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
  2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Suspended Luminaires:
1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  2. Install canopies tight to mounting surface.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- M. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- N. Identify luminaires connected to emergency power system in accordance with Section 26 0553.
- O. Install lamps in each luminaire.

### **3.03 FIELD QUALITY CONTROL**

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

**END OF SECTION**

## **SECTION 26 5600 EXTERIOR LIGHTING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Exterior luminaires.
- B. Ballasts and Drivers.
- C. Poles and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Division 03 - Concrete: Materials and installation requirements for concrete bases for poles.
- D. Section 26 0005 - Basic Electrical Requirements.
- E. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- F. Section 26 0529 - Hangers and Supports for Electrical Systems.
- G. Section 26 0533.16 - Boxes for Electrical Systems.
- H. Section 26 0935 - Distributed Digital Lighting Control System: Automatic controls for lighting including outdoormotion sensors and outdoor photo controls.
- I. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.
- J. Section 26 5100 - Interior Lighting.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2010.
- B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).
- C. IEEE C2 - National Electrical Safety Code 2017.
- D. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).
- E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
- F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- G. IES RP-8 - Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting 2018.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- I. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2006.
- J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2016.
- K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.
- L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 1598 - Luminaires Current Edition, Including All Revisions.
- N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:



1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### **1.05 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

### **PART 2 PRODUCTS**

#### **2.01 LUMINAIRE TYPES**

- A. Furnish products as indicated in luminaire schedule included on the drawings.

#### **2.02 LUMINAIRES**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- H. Recessed Luminaires:
  1. Ceiling Compatibility: Comply with NEMA LE 4.
  2. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- I. LED Luminaires:
  1. Components: UL 8750 recognized or listed as applicable.
  2. Tested in accordance with IES LM-79 and IES LM-80.
  3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- J. Exposed Hardware: Stainless steel.

#### **2.03 BALLASTS AND DRIVERS**

- A. Ballasts/Drivers - General Requirements:
  1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

#### **2.04 POLES**

- A. All Poles:
  1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
  2. Structural Design Criteria:
    - a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
  3. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
  4. Unless otherwise indicated, provide with the following features/accessories:
    - a. Top cap.
    - b. Handhole.

- c. Anchor bolts with leveling nuts or leveling shims.
- d. Anchor base cover.
- e. Provision for pole-mounted weatherproof GFI receptacle where indicated.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- B. Verify that suitable support frames are installed where required.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.02 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### **3.03 INSTALLATION**

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Pole-Mounted Luminaires:
  - 1. Grounding:
    - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
  - 2. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
  - 3. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 2726 in designated poles.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Install lamps in each luminaire.

**END OF SECTION**

**SECTION 28 4600  
FIRE DETECTION AND ALARM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Circuits from protected premises to supervising station, including conduit.
- D. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.
- E. Maintenance of fire alarm system under contract for specified warranty period.

**1.02 RELATED REQUIREMENTS**

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Division 07 - Thermal and Moisture Protection: Materials and methods for work to be performed by this installer.
- D. Division 08 - Openings: Door hardware, coiling fire doors and smoke and/or fire curtains to be released by fire alarm system.
- E. Division 14 - Conveying Equipment: Elevator systems monitored and controlled by fire alarm system and sensors and interlocks by fire alarm system.
- F. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- G. Section 21 3000 - Fire Pumps: Supervisory devices.
- H. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.
- I. Section 26 0005 - Basic Electrical Requirements.
- J. Section 26 0505 - Selective Demolition for Electrical
- K. Section 26 0533.13 - Conduit for Electrical Systems.
- L. Section 26 0533.16 - Boxes for Electrical Systems.
- M. Section 26 0553 - Identification for Electrical Systems.

**1.03 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.
- F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Evidence of designer qualifications.

- C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - 1. Copy (if any) of list of data required by authority having jurisdiction.
  - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
  - 4. System zone boundaries and interfaces to fire safety systems.
  - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
  - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
  - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
  - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  - 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
  - 11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
  - 12. Certification by Contractor that the system design complies with Contract Documents.
- D. Evidence of installer qualifications.
- E. Evidence of instructor qualifications; training lesson plan outline.
- F. Evidence of maintenance contractor qualifications, if different from installer.
- G. Inspection and Test Reports:
  - 1. Submit inspection and test plan prior to closeout demonstration.
  - 2. Submit documentation of satisfactory inspections and tests.
  - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- H. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
  - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
  - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  - 4. List of recommended spare parts, tools, and instruments for testing.
  - 5. Replacement parts list with current prices, and source of supply.
  - 6. Detailed troubleshooting guide and large scale input/output matrix.
  - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
  - 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- I. Project Record Documents: Have one set available during closeout demonstration:
  - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
  - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- J. Closeout Documents:
  - 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

## **1.05 QUALITY ASSURANCE**

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
  1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
  2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
  3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
- C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Fire Alarm Control Units and Accessories:
  1. Honeywell Security & Fire Solutions/Notifier: [www.notifier.com](http://www.notifier.com).
  2. National Time & Signal: [www.natsco.net](http://www.natsco.net).
  3. Siemens Building Technologies, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
  4. Simplex, a brand of Johnson Controls: [www.simplex-fire.com](http://www.simplex-fire.com).
  5. Provide control units made by the same manufacturer.
- B. Initiating Devices and Notification Appliances:
  1. Same manufacturer as control units.
  2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

### **2.02 FIRE ALARM SYSTEM**

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
  1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
  2. Protected Premises: Entire building shown on drawings.
  3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    - a. ADA Standards.
    - b. The requirements of the local authority having jurisdiction.
    - c. Applicable local codes.
    - d. Contract Documents (drawings and specifications).
    - e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
  4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
  5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
  6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
  7. Program notification zones and voice messages as directed by Owner.

8. Fire Alarm Control Unit: New, located at supervising station.
- B. Supervising Stations and Fire Department Connections:
  1. Public Fire Department Notification: By on-premises supervising station.
  2. On-Premises Supervising Station: New proprietary station operated by Owner, located at check-in desk..
  3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
- C. Circuits:
  1. Initiating Device Circuits (IDC): Class B, Style A.
  2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
  3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Spare Capacity:
  1. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- E. Power Sources:
  1. Primary: Dedicated branch circuits of the facility power distribution system.
  2. Secondary: Storage batteries.
  3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
  4. Each Computer System: Provide uninterruptible power supply (UPS).

## **2.03 FIRE SAFETY SYSTEMS INTERFACES**

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
  1. Sprinkler water control valves.
  2. Dry-pipe sprinkler system pressure.
  3. Dry-pipe sprinkler valve room low temperature.
  4. Fire pump(s).
  5. Elevator shut-down control circuits.
  6. Chute interlocks and controls.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
  1. Sprinkler water flow.
  2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
- C. Elevators:
  1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
  2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
  3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
- D. HVAC:
  1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
- E. Doors:
  1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
  2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Division 08.

## **2.04 COMPONENTS**

- A. General:
  1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
  2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.

- D. Remote Annunciators: locate per plans.
- E. Initiating Devices:
  - 1. Addressable Systems:
    - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
    - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- H. Locks and Keys: Deliver keys to Owner.
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
  - 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
  - 2. Provide one for each control unit where operations are to be performed.
  - 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
  - 4. Provide extra copy with operation and maintenance data submittal.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

### **3.02 INSPECTION AND TESTING FOR COMPLETION**

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

### **3.03 OWNER PERSONNEL INSTRUCTION**

- A. Provide the following instruction to designated Owner personnel:
  - 1. Hands-On Instruction: On-site, using operational system.
  - 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
  - 1. Initial Training: 1 session pre-closeout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
  - 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

### **3.04 CLOSEOUT**

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
  - 1. Be prepared to conduct any of the required tests.
  - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
  - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
  - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
  - 5. Repeat demonstration until successful.

### **3.05 MAINTENANCE**

- A. See Division 01 for additional requirements relating to maintenance service.
- B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
  - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
  - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
  - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- C. Provide trouble call-back service upon notification by Owner:
  - 1. Provide on-site response within 2 hours of notification.
  - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  - 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- F. Comply with Owner's requirements for access to facility and security.

### **END OF SECTION**