

**PROJECT MANUAL AND SPECIFICATIONS  
FOR**

# **Henrico County Human Services & Social Services Lobby Renovation**

**8600 Dixon Powers Drive  
Richmond, Virginia 23228**

**Permit Set  
June 14, 2024**



**Prepared by:**



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**SECTION 011000**  
**SUMMARY**

**PART 1 GENERAL**

**1.01 PROJECT**

- A. Project Name: Henrico County Social Services Lobby Renovation
- B. Owner's Name: Henrico County.
- C. Architect's Name: nbj Architecture.
- D. The Project consists of the alteration of portions of the building lobby and social services suite as shown in the Contract Documents.

**1.02 DESCRIPTION OF ALTERATIONS WORK**

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.
- B. Scope of alterations work is indicated on drawings and in the Project Manual.
- C. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- D. HVAC: Alter existing system and add new construction, keeping existing in operation.
- E. Electrical Power and Lighting: Alter existing and add new construction.
- F. Fire Suppression Sprinklers: Alter existing system and add new construction, keeping existing in operation.
- G. Fire Alarm: Replace existing system with new construction, keeping existing in operation until ready for changeover.
- H. Owner will remove the following items before start of work:
  - 1. Loose furniture and equipment.

**1.03 OWNER OCCUPANCY**

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

**1.04 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site and premises to allow:
  - 1. Owner occupancy.
- C. Provide access to and from site as required by law and by Owner:
  - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Existing building spaces outside the work area may not be used for storage.
- E. Time Restrictions:
  - 1. Limit conduct of especially noisy work to the hours of 5:00 PM to 8:00 AM.
- F. Utility Outages and Shutdown:
  - 1. Limit disruption of utility services to hours the building is unoccupied.
  - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
  - 3. Prevent accidental disruption of utility services to other facilities.

**1.05 WORK SEQUENCE**

- A. Construct Work in phases during the construction period:
  - 1. Phase 1: Main building vestibule, bathrooms, lobby, stairs..
  - 2. Phase 2: Social Services lobby and office space.
- B. Coordinate construction schedule and operations with Owner.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 011000**

**SECTION 012100  
ALLOWANCES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Cash allowances.

**1.02 CASH ALLOWANCES**

- A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts.
- B. Architect Responsibilities:
  - 1. Select products in consultation with Owner and transmit decision to Contractor.
- C. Contractor Responsibilities:
  - 1. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
  - 2. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
  - 3. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

**1.03 ALLOWANCES SCHEDULE**

- A. Include the stipulated sum of \$5,000 for purchase, delivery, and installation of ceiling mounted speakers and associated wiring within the project scope area.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 012100**

**SECTION 012300  
ADDITIVE BID ITEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description of Additive Bid Items.

**1.02 ACCEPTANCE OF ADDITIVE BID ITEMS**

- A. Additive Bid Items quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Additive Bid Items will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Additive Bid Item.

**1.03 SCHEDULE OF ADDITIVE BID ITEMS**

- A. Additive Bid Item No. 1 - Renovation of Women's 105 and Men's 106.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 012300**

**SECTION 012500  
SUBSTITUTION PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

**1.02 DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
  - 1. No specific form is required. Contractor's Substitution Request documentation must include the following:
    - a. Project Information:
    - b. Substitution Request Information:
      - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
      - 2) Issue date.
      - 3) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
      - 4) Description of Substitution.
      - 5) Reason why the specified item cannot be provided.
      - 6) Differences between proposed substitution and specified item.
      - 7) Description of how proposed substitution affects other parts of work.
    - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
      - 1) Physical characteristics.
      - 2) In-service performance.
      - 3) Visual effect.
      - 4) Warranties.
      - 5) Include, as appropriate or requested, the following types of documentation:
        - (a) Product Data:
        - (b) Samples.
        - (c) Certificates, test, reports or similar qualification data.
        - (d) Drawings, when required to show impact on adjacent construction elements.

- d. Impact of Substitution:
  - 1) Savings to Owner for accepting substitution.
  - 2) Change to Contract Time due to accepting substitution.
- D. Limit each request to a single proposed substitution item.
  - 1. Submit an electronic document, combining the request form with supporting data into single document.

### **3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Submit request for Substitution within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- B. Substitutions will not be considered under one or more of the following circumstances:
  - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  - 2. Without a separate written request.

### **3.03 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
  - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

### **3.04 ACCEPTANCE**

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

### **3.05 CLOSEOUT ACTIVITIES**

- A. Include completed Substitution Request Forms as part of the Project record.

**END OF SECTION 012500**

**SECTION 013000**  
**ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Submittals for review, information, and project closeout.
- F. Number of copies of submittals.
- G. Requests for Interpretation (RFI) procedures.
- H. Submittal procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 016000 - Product Requirements: General product requirements.
- B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

**1.03 GENERAL ADMINISTRATIVE REQUIREMENTS**

- A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
  - 1. Requests for Interpretation (RFI).
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Applications for payment and change order requests.
  - 7. Progress schedules.
  - 8. Coordination drawings.
  - 9. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 10. Closeout submittals.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRECONSTRUCTION MEETING**

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.
  - 3. Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
  - 5. Submission of initial Submittal schedule.



6. Designation of personnel representing the parties to Contract and Architect.
  7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  8. Scheduling.
- D. Architect will record minutes and distribute electronic copies within five working days to the Contractor, Owner, attendees, and those affected by decisions made.

### **3.02 PROGRESS MEETINGS**

- A. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- B. Attendance Required:
1. Contractor.
  2. Owner.
  3. Architect.
  4. Contractor's superintendent.
  5. Major subcontractors.
- C. Agenda:
1. Review minutes of previous meetings.
  2. Review of work progress.
  3. Field observations, problems, and decisions.
  4. Identification of problems that impede, or will impede, planned progress.
  5. Review of submittals schedule and status of submittals.
  6. Review of RFIs log and status of responses.
  7. Review of off-site fabrication and delivery schedules.
  8. Maintenance of progress schedule.
  9. Corrective measures to regain projected schedules.
  10. Planned progress during succeeding work period.
  11. Maintenance of quality and work standards.
  12. Effect of proposed changes on progress schedule and coordination.
  13. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.03 CONSTRUCTION PROGRESS SCHEDULE**

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

### **3.04 REQUESTS FOR INTERPRETATION (RFI)**

- A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
  2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
  - 1. Prepare a separate RFI for each specific item.
    - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    - b. Do not forward requests which solely require internal coordination between subcontractors.
  - 2. Prepare in a format and with content acceptable to Owner.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
  - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
  - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
    - a. Approval of submittals (use procedures specified elsewhere in this section).
    - b. Approval of substitutions (see Section - 016000 - Product Requirements)
  - 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
  - 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
    - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
  - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
  - 2. Discrete and consecutive RFI number, and descriptive subject/title.
  - 3. Issue date, and requested reply date.
  - 4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
  - 5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
  - 6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
  - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead

to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

### **3.05 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
  1. Coordinate with Contractor's construction schedule and schedule of values.
  2. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
  3. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

### **3.06 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  1. Product data.
  2. Shop drawings.
  3. Samples for selection.
  4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

### **3.07 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  1. Design data.
  2. Certificates.
  3. Test reports.
  4. Inspection reports.
  5. Manufacturer's instructions.
  6. Manufacturer's field reports.
  7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

### **3.08 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
  1. Project record documents.
  2. Operation and maintenance data.
  3. Warranties.

4. Bonds.
  5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### **3.09 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit 3 samples; one of which will be retained by Architect.
1. After review, produce duplicates.
  2. Retained samples will not be returned to Contractor unless specifically so stated.

### **3.10 SUBMITTAL PROCEDURES**

- A. General Requirements:
1. Use a single transmittal for related items.
  2. Transmit using approved form.
    - a. Use Contractor's form, subject to prior approval by Architect.
  3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
  4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
  5. Apply Contractor's stamp, signed or initialed certifying that review, approval, 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.
    - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
  6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
    - a. Send submittals in electronic format via email to Architect.
  7. Schedule submittals to expedite the Project, and coordinate submission of related items.
    - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
  8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
  9. Provide space for Contractor and Architect review stamps.
  10. When revised for resubmission, identify all changes made since previous submission.
  11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
  12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
  13. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
  2. Collect required information into a single submittal.
  3. Submit concurrently with related shop drawing submittal.
  4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
  2. Do not reproduce Contract Documents to create shop drawings.
  3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:

1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

### **3.11 SUBMITTAL REVIEW**

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
  1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
  1. Authorizing purchasing, fabrication, delivery, and installation:
    - a. "No Exceptions Taken".
    - b. "Make Changes Noted", or language with same legal meaning.
      - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
    - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
  2. Not Authorizing fabrication, delivery, and installation:
    - a. "Revise and Resubmit".
      - 1) Resubmit revised item, with review notations acknowledged and incorporated.
    - b. "Rejected".
      - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
  1. Items for which no action was taken:
    - a. "Received" - to notify the Contractor that the submittal has been received for record only.
  2. Items for which action was taken:
    - a. "Reviewed" - no further action is required from Contractor.

**END OF SECTION 013000**

**SECTION 014100  
REGULATORY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SUMMARY OF REFERENCE STANDARDS**

- A. Regulatory requirements applicable to this project are the following:
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
- D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- E. Virginia Statewide Fire Prevention Code; 2018.
- F. Virginia Construction Code; 2018.
- G. Virginia Plumbing Code; 2018.
- H. Virginia Mechanical Code; 2018.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. Virginia Energy Conservation Code; 2018.
- K. Virginia Existing Building Code; 2018.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 014100**

**SECTION 014216**  
**DEFINITIONS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This section supplements the definitions contained in the General Conditions.
- B. Other definitions are included in individual specification sections.

**1.02 DEFINITIONS**

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: To furnish and install.
- F. Supply: Same as Furnish.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 014216**

**SECTION 015000**  
**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary utilities.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers and enclosures.
- D. Vehicular access and parking.
- E. Waste removal facilities and services.

**1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

**1.03 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power, consisting of access to existing systems. The Contractor shall be responsible for all temporary connections.
  - 2. Water supply, consisting of access to existing systems. The Contractor shall be responsible for all temporary connections.
- B. Existing facilities may not be used.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

**1.04 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

**1.05 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**1.06 INTERIOR ENCLOSURES**

- A. Provide temporary partitions as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: For walls, framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces. For ceilings, framing and reinforced polyethylene sheet materials with closed joints and sealed edges:
  - 1. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Paint drywall surfaces exposed to view from Owner-occupied areas.

**1.07 VEHICULAR ACCESS AND PARKING**

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Designated existing on-site roads may be used for construction traffic.



- D. Existing parking areas located at areas designated by the Owner may be used for construction parking.

**1.08 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

**1.09 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.
- D. Restore new permanent facilities used during construction to specified condition.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 015000**

**SECTION 016000  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Re-use of existing products.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 RELATED REQUIREMENTS**

- A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

**1.03 SUBMITTALS**

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

**PART 2 PRODUCTS**

**2.01 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

**2.02 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
  - 1. Made of wood from newly cut old growth timber.
  - 2. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
  - 1. Are extracted, harvested, and/or manufactured closer to the location of the project.
  - 2. Have longer documented life span under normal use.
  - 3. Are made of recycled materials.

**2.03 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

## **2.04 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

## **PART 3 EXECUTION**

### **3.01 SUBSTITUTION LIMITATIONS**

- A. See Section 012500 - Substitution Procedures.

### **3.02 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.03 STORAGE AND PROTECTION**

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor areas.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- F. For exterior storage of fabricated products, place on sloped supports above ground.
- G. Provide off-site storage and protection when site does not permit on-site storage or protection.
- H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- I. Comply with manufacturer's warranty conditions, if any.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION 016000**



**SECTION 017000**  
**EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Cutting and patching.
- D. Cleaning and protection.
- E. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 013000 - Administrative Requirements: Submittals procedures.
- C. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- D. Section 015000 - Temporary Facilities and Controls: Temporary interior partitions.
- E. Section 078400 - Firestopping.

**1.03 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2019.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

**1.05 QUALIFICATIONS**

- A. For demolition work, employ a firm specializing in the type of work required.

**1.06 PROJECT CONDITIONS**

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent areas.
  - 1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
  - 1. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.
- E. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

## **1.07 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new 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.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. 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.

## **PART 2 PRODUCTS**

### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **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 manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### 3.03 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

### 3.04 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
  - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
  - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
- D. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
  - 2. Remove items indicated on drawings.
  - 3. Relocate items indicated on drawings.
  - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
  - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. Provide temporary connections as required to maintain existing systems in service.
  - 4. Verify that abandoned services serve only abandoned facilities.

5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
    1. Prevent movement of structure; provide shoring and bracing if necessary.
    2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
    3. Repair adjacent construction and finishes damaged during removal work.
  - G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
    1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
    2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
    3. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
  - H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
  - I. Refinish existing surfaces as indicated:
    1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
    2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
  - J. Clean existing systems and equipment.
  - K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
  - L. Do not begin new construction in alterations areas before demolition is complete.
  - M. Comply with all other applicable requirements of this section.

### **3.05 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
  1. Complete the work.
  2. Fit products together to integrate with other work.
  3. Provide openings for penetration of mechanical, electrical, and other services.
  4. Match work that has been cut to adjacent work.
  5. Repair areas adjacent to cuts to required condition.
  6. Repair new work damaged by subsequent work.
  7. Remove samples of installed work for testing when requested.
  8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.



- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.
- J. Patching:
  1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  2. Match color, texture, and appearance.
  3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.06 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### **3.07 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.08 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### **3.09 FINAL CLEANING**

- A. Execute final cleaning prior to final project assessment.
  1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

- F. Clean filters of operating equipment.
- G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.10 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

**END OF SECTION 017000**

**SECTION 017800  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

**1.02 RELATED REQUIREMENTS**

- A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed shop drawings, product data, and samples.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Product substitutions or alternates utilized.
  2. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  2. Field changes of dimension and detail.
  3. Details not on original Contract drawings.

### **3.02 OPERATION AND MAINTENANCE DATA**

- A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For Each Product, Applied Material, and Finish:
  1. Product data, with catalog number, size, composition, and color and texture designations.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Additional information as specified in individual product specification sections.
- D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  1. Description of unit or system, and component parts.
  2. Identify function, normal operating characteristics, and limiting conditions.
  3. Include performance curves, with engineering data and tests.
  4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Include manufacturer's printed operation and maintenance instructions.
- F. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- G. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- H. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- I. Additional Requirements: As specified in individual product specification sections.

### **3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. Assemble operation and maintenance data into thumb drives for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate folder for each system.
- C. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- D. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- E. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Project Directory.
  - 2. Table of Contents, of all volumes, and of this volume.
  - 3. Operation and Maintenance Data: Arranged by system, then by product category.
    - a. Source data.
    - b. Product data, shop drawings, and other submittals.
    - c. Operation and maintenance data.
    - d. Field quality control data.

### **3.06 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

**END OF SECTION 017800**

**SECTION 055000**  
**METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Shop fabricated steel items.

**1.02 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
- C. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

**PART 2 PRODUCTS**

**2.01 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36/A36M.
- B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

**2.02 FABRICATED ITEMS**

- A. Toilet Partition Suspension Members: Steel channel and/or angle sections; prime paint finish.

**2.03 FINISHES - STEEL**

- A. Prime paint steel items.
- B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- C. Prime Painting: One coat.

**2.04 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

**3.02 PREPARATION**

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

**3.03 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions.

**END OF SECTION 055000**

**SECTION 061000  
ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire retardant treated wood materials.
- B. Concealed wood blocking, nailers, and supports.

**1.02 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2018.
- D. PS 20 - American Softwood Lumber Standard; 2020.
- E. SPIB (GR) - Grading Rules; 2014.

**1.03 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Southern Pine, unless otherwise indicated.
  - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee ([www.alsc.org](http://www.alsc.org)) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

**2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

**2.03 ACCESSORIES**

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M.

**2.04 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
- B. Fire Retardant Treatment:



1. Interior Type A: AWWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
  - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
  - b. Treat rough carpentry items as indicated .
  - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

### **3.02 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific non-structural framing and blocking:
  1. Cabinets and shelf supports.
  2. Wall brackets.
  3. Handrails.
  4. Grab bars.
  5. Towel and bath accessories.
  6. Wall-mounted door stops.
  7. Joints of rigid wall coverings that occur between studs.

**END OF SECTION 061000**

**SECTION 064100**  
**ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 123600 - Countertops.

**1.03 REFERENCE STANDARDS**

- A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
- C. Product Data: Provide data for hardware accessories.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

**1.06 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

**PART 2 PRODUCTS**

**2.01 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

**2.02 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.

**2.03 LAMINATE MATERIALS**

- A. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
  - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as indicated, finish as indicated.
  - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
  - 3. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

**2.04 COUNTERTOPS**

- A. Countertops are specified in Section 123600.

## **2.05 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
  - 1. Color: As selected by Architect from manufacturer's full range.
  - 2. Use at all exposed plywood edges.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized finish in concealed locations and stainless steel finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

## **2.06 HARDWARE**

- A. Fixed Standard Shelf, Countertop, and Workstation Brackets:
  - 1. Material: Steel.
  - 2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
  - 3. Color: White.

## **2.07 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.
  - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining elements.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure counter bases to floor using appropriate angles and anchorages.

### **3.03 ADJUSTING**

- A. Adjust installed work.

**3.04 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

**END OF SECTION 064100**

**SECTION 079200  
JOINT SEALANTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

**1.02 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

**1.04 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

**PART 2 PRODUCTS**

**2.01 JOINT SEALANT APPLICATIONS**

- A. Scope:
  - 1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    - a. Joints between door, window, and other frames and adjacent construction.
    - b. Other joints indicated below.
  - 2. Do not seal the following types of joints.
    - a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    - b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    - c. Joints where installation of sealant is specified in another section.

- d. Joints between suspended panel ceilings/grid and walls.
- B. Type 1 - Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
  - 1. Type 2 - Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
  - 2. Type 4 - Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
  - 3. Type 3 - Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
- C. Interior Wet Areas: restrooms; fixtures in wet areas include plumbing fixtures, countertops, and other similar items.

## **2.02 NONSAG JOINT SEALANTS**

- A. Type 3 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
  - 1. Color: White.
- B. Type 2 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 50 percent, minimum.
  - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's full range.
- C. Type 4 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
  - 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Color: To be selected by Architect from manufacturer's standard range.
- D. Type 2 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
  - 1. Color: To be selected by Architect from manufacturer's full range.

## **2.03 ACCESSORIES**

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
  - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
  - 2. Open Cell: 40 to 50 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

**END OF SECTION 079200**

**SECTION 081416  
FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Flush wood doors; flush configuration; non-rated.

**1.02 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware.
- B. Section 088000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door veneer, 6 by 6 inches in size, minimum, illustrating wood grain, stain color, and sheen.
- E. Warranty, executed in Owner's name.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

**1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

**PART 2 PRODUCTS**

**2.01 DOORS AND PANELS**

- A. Doors: See drawings for locations and additional requirements.
  - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
  - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.
  - 2. Wood veneer facing with factory transparent finish.

**2.02 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.



### **2.03 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: White Maple, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
  - 1. Vertical and Horizontal Edges: Same species as face veneer.
- B. Facing Adhesive: Type I - waterproof.

### **2.04 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

### **2.05 FINISHES - WOOD VENEER DOORS**

- A. Finish work in accordance with AWI/AWMA/WI (AWS) or AWMA/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 5, Varnish, Conversion.
    - b. Sheen: Satin.
- B. Factory finish doors in accordance with approved sample.

### **2.06 ACCESSORIES**

- A. Glazing: See Section 088000.
- B. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.
- C. Door Hardware: See Section 087100.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

### **3.03 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

**END OF SECTION 081416**

**SECTION 083100**  
**ACCESS DOORS AND PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wall and ceiling mounted access units.

**1.02 REFERENCE STANDARDS**

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Project Record Documents: Record actual locations of each access unit.

**PART 2 PRODUCTS**

**2.01 ACCESS DOORS AND PANELS ASSEMBLIES**

- A. Wall-Mounted Units with Return Air Grille:
  - 1. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
  - 2. Size: 12 by 12 inches.
  - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- B. Ceiling-Mounted Units:
  - 1. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
  - 2. Size - Other Ceilings: 12 by 12 inches.
  - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

**2.02 WALL AND CEILING MOUNTED ACCESS UNITS**

- A. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  - 1. Style: Exposed frame with door surface flush with frame surface.
    - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
  - 2. Door Style: Single thickness with rolled or turned in edges.
  - 3. Heavy Duty Frames: 14 gauge, 0.0747 inch, minimum thickness.
  - 4. Heavy Duty Single Steel Sheet Door Panels: 14 gauge, 0.0747 inch, minimum thickness.
  - 5. Steel Finish: Primed.
  - 6. Door/Panel Size: 12 x 12 inch, minimum. If access panel is serving maintenance items, such as mechanical filter replacements, size is to accommodate the maintenance item.
  - 7. Hardware:
    - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    - b. Latch/Lock: Screw driver slot for quarter turn cam latch.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

**3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to proceeding with this work.

- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

### **3.03 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

**END OF SECTION 083100**

**SECTION 084313**  
**ALUMINUM-FRAMED STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.
- D. Door hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 088000 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

**1.06 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

**1.07 WARRANTY**

- A. See Section 017800 - 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 ALUMINUM-FRAMED STOREFRONT**

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Glazing Rabbet: For 1/4 inch monolithic glazing.
  - 2. Glazing Position: Centered (front to back).
  - 3. Vertical and Horizontal Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
  - 4. Finish: Class I natural anodized.
    - a. Factory finish all surfaces that will be exposed in completed assemblies.
    - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  - 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  - 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  - 8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
  - 9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  - 10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
  - 11. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

### **2.02 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
  - 1. Framing members for interior applications need not be thermally broken.
  - 2. Glazing Stops: Flush.
- B. Glazing: As specified in Section 088000.
- C. Swing Doors: Glazed aluminum.
  - 1. Thickness: 1-3/4 inches.
  - 2. Top Rail: 5 inches wide.
  - 3. Vertical Stiles: 5 inches wide.
  - 4. Bottom Rail: 12 inches wide.
  - 5. Glazing Stops: Square.
  - 6. Finish: Same as storefront.

### **2.03 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Sealant for Setting Thresholds: Non-curing butyl type.
- D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

## **2.04 FINISHES**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

## **2.05 HARDWARE**

- A. For each door, include weatherstripping and sill sweep strip.
- B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- C. Sill Sweep Strips: Resilient seal type, of neoprene; provide on all doors.
- D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on Building Vestibule Door.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other work.

### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Set thresholds in bed of sealant and secure.
- I. Install hardware using templates provided.
- J. Install glass in accordance with Section 088000, using glazing method required to achieve performance criteria.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### **3.04 ADJUSTING**

- A. Adjust operating hardware and sash for smooth operation.

### **3.05 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

### **3.06 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION 084313**

**SECTION 087100  
DOOR HARDWARE**

**PART 1 - GENERAL**

**1.01 SUMMARY**

**A. Section includes:**

1. Mechanical and electrified door hardware

**B. Section excludes:**

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

**C. Related Sections:**

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
  - a. "Flush Wood Doors"
  - b. "Aluminum-Framed Entrances and Storefronts"
6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

**1.02 REFERENCES**

**A. UL, LLC**

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

**B. DHI - Door and Hardware Institute**

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware

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3. Keying Systems and Nomenclature
  4. Installation Guide for Doors and Hardware
- C. NFPA – National Fire Protection Association
1. NFPA 70 – National Electric Code
  2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
  3. NFPA 101 – Life Safety Code
  4. NFPA 105 – Smoke and Draft Control Door Assemblies
  5. NFPA 252 – Fire Tests of Door Assemblies
- D. ANSI - American National Standards Institute
1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
  2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
  3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
  4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
  5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

### 1.03 SUBMITTALS

#### A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
  - a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
  - b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
  - c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

#### B. Action Submittals:

1. Product Data: Submit 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. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
  - a. Wiring Diagrams: For power, signal, and control wiring and including:
    - 1) Details of interface of electrified door hardware and building safety and security systems.
    - 2) Schematic diagram of systems that interface with electrified door hardware.
    - 3) Point-to-point wiring.
    - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

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- a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

- a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
- b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
- c. Indicate complete designations of each item required for each opening, include:
  - 1) Door Index: door number, heading number, and Architect's hardware set number.
  - 2) Quantity, type, style, function, size, and finish of each hardware item.
  - 3) Name and manufacturer of each item.
  - 4) Fastenings and other pertinent information.
  - 5) Location of each hardware set cross-referenced to indications on Drawings.
  - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
  - 7) Mounting locations for hardware.
  - 8) Door and frame sizes and materials.
  - 9) Degree of door swing and handing.
  - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

- 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
- 2. Provide Product Data:
  - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
  - b. Include warranties for specified door hardware.

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D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
  - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
  - b. Catalog pages for each product.
  - c. Final approved hardware schedule edited to reflect conditions as installed.
  - d. Final keying schedule
  - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
  - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
  - a. For door hardware: DHI certified AHC or DHC.
  - b. Can provide installation and technical data to Architect and other related subcontractors.
  - c. Can inspect and verify components are in working order upon completion of installation.
  - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

B. Certifications:

1. Fire-Rated Door Openings:
  - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
  - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
2. Smoke and Draft Control Door Assemblies:

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- a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
    - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
  - 3. Electrified Door Hardware
    - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
  - 4. Accessibility Requirements:
    - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
- 1. Keying Conference
    - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      - 2) Preliminary key system schematic diagram.
      - 3) Requirements for key control system.
      - 4) Requirements for access control.
      - 5) Address for delivery of keys.
  - 2. Pre-installation Conference
    - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    - b. Inspect and discuss preparatory work performed by other trades.
    - c. Inspect and discuss electrical roughing-in for electrified door hardware.
    - d. Review sequence of operation for each type of electrified door hardware.
    - e. Review required testing, inspecting, and certifying procedures.
    - f. Review questions or concerns related to proper installation and adjustment of door hardware.
  - 3. Electrified Hardware Coordination Conference:
    - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

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- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

#### 1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. 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. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

#### 1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
  - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
  - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    - a. Mechanical Warranty
      - 1) Locks
        - a) Schlage ND Series: 10 years
      - 2) Exit Devices
        - a) Von Duprin: 3 years
      - 3) Closers
        - a) LCN 4000 Series: 30 years
      - 4) Automatic Operators
        - a) LCN: 2 years
    - b. Electrical Warranty

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- 1) Electric Strikes
  - a) Von Duprin: 1 year

## 1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Owner has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
  1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

### 2.02 MATERIALS

- A. Fabrication
  1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
  2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
  3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

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- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
  - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

## 2.03 HINGES

### A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
  - a. Ives 5BB series
- 2. Acceptable Manufacturers and Products:
  - a. Hager BB1191/1279 series
  - b. McKinney TB series
  - c. Stanley FBB series

### B. Requirements:

- 1. Provide hinges conforming to ANSI/BHMA A156.1.
- 2. Provide five knuckle, ball bearing hinges.
- 3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
  - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
  - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
- 4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
  - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 5. 2 inches or thicker doors:
  - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
- 7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
- 8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
- 9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - a. Steel Hinges: Steel pins
  - b. Non-Ferrous Hinges: Stainless steel pins
  - c. Out-Swinging Exterior Doors: Non-removable pins
  - d. Out-Swinging Interior Lockable Doors: Non-removable pins
  - e. Interior Non-lockable Doors: Non-rising pins
- 10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

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## 2.04 CONTINUOUS HINGES

### A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Ives
2. Acceptable Manufacturers:
  - a. Select
  - b. ABH

### B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

## 2.05 FLUSH BOLTS

### A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Ives
2. Acceptable Manufacturers:
  - a. Burns
  - b. Trimco

### B. Requirements:

1. Provide manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

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## 2.06 CYLINDRICAL LOCKS – GRADE 1

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. Schlage ND series
2. Acceptable Manufacturers and Products:
  - a. Sargent 11-Line
  - b. Corbin-Russwin CL3100 series

### B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
  - a. Lever Design: Rhodes

## 2.07 ELECTRIC STRIKES

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. Von Duprin 6000 Series.
2. Acceptable Manufacturers and Products:
  - a. Folger Adam 300 Series
  - b. HES 1006 Series

### B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

## 2.08 POWER SUPPLIES

### A. Manufacturers and Products:

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1. Scheduled Manufacturer and Product:
  - a. Schlage/Von Duprin PS900 Series
2. Acceptable Manufacturers and Products:
  - a. Dynalock 5000 series
  - b. Securitron BPS series
  - c. Security Door Controls 600 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
  - a. 12/24 VDC Output, field selectable.
  - b. Class 2 Rated power limited output.
  - c. Universal 120-240 VAC input.
  - d. Low voltage DC, regulated and filtered.
  - e. Polarized connector for distribution boards.
  - f. Fused primary input.
  - g. AC input and DC output monitoring circuit w/LED indicators.
  - h. Cover mounted AC Input indication.
  - i. Tested and certified to meet UL294.
  - j. NEMA 1 enclosure.
  - k. Hinged cover w/lock down screws.
  - l. High voltage protective cover.

## 2.09 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
  - a. Corbin Russwin
2. Acceptable Manufacturers and Products:
  - a. No Substitute

B. Requirements:

1. Owner will provide permanent IC cores.

## 2.10 KEYING

A. Requirements:

1. Construction Keying:
  - a. Disposable Construction Cores.
    - 1) Provide disposable construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
      - a) 3 construction control keys
      - b) 12 construction change (day) keys.
    - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

## 2.11 DOOR CLOSERS

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. LCN 4040XP series
2. Acceptable Manufacturers and Products:
  - a. Corbin-Russwin DC8000 series
  - b. Sargent 281 series

### B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

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## 2.12 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. LCN Senior Swing
2. Acceptable Manufacturers and Products:
  - a. Horton 4000LE series
  - b. Stanley M-Force

### B. Requirements:

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI/BHMA A156.19.
  - a. Opening: Powered by DC motor working through reduction gears.
  - b. Closing: Spring force.
  - c. Manual, hydraulic, or chain drive closers: Not permitted.
  - d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
  - e. Cover: Aluminum.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 1 to 32 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, and adapters for arms as required to suit details.
4. Provide hard-wired motion sensors and/or actuator switches, and receivers for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

## 2.13 DOOR TRIM

### A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Ives.
2. Acceptable Manufacturers:
  - a. Trimco
  - b. Burns

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B. Requirements:

1. Provide push plates, push bars, pull plates, pulls with diameter and length as scheduled.

## 2.14 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Ives
2. Acceptable Manufacturers:
  - a. Burns
  - b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

## 2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Ives
2. Acceptable Manufacturers:
  - a. Trimco
  - b. Burns

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

## 2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Zero International

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2. Acceptable Manufacturers:

- a. National Guard
- b. Reese

B. Requirements:

- 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
- 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
- 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
- 4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

## 2.17 SILENCERS

A. Manufacturers:

- 1. Scheduled Manufacturer:
  - a. Ives
- 2. Acceptable Manufacturers:
  - a. Burns
  - b. Trimco

B. Requirements:

- 1. Provide "push-in" type silencers for hollow metal or wood frames.
- 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
- 3. Omit where gasketing is specified.

## 2.18 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

- 1. Hinges at Exterior Doors: BHMA 630 (US32D)
- 2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
- 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
- 4. Protection Plates: BHMA 630 (US32D)
- 5. Door Closers: Powder Coat to Match
- 6. Wall Stops: BHMA 630 (US32D)
- 7. Weatherstripping: Clear Anodized Aluminum
- 8. Thresholds: Mill Finish Aluminum

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## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
  - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
  - 2. Field modify and prepare existing doors and frames for new hardware being installed.
  - 3. When modifications are exposed to view, use concealed fasteners, when possible.
  - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
    - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

### 3.03 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  - 2. Custom Steel Doors and Frames: HMMA 831.
  - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
  - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

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- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
  - 1. Install construction cores to secure building and areas during construction period.
  - 2. Owner will replace construction cores with permanent cores as indicated in keying section.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
  - 1. Conduit, junction boxes and wire pulls.
  - 2. Connections to and from power supplies to electrified hardware.
  - 3. Connections to fire/smoke alarm system and smoke evacuation system.
  - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
  - 5. Connections to panel interface modules, controllers, and gateways.
  - 6. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

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- R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

### 3.04 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.


### 3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### 3.06 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Legend:














-  Link to catalog cut sheet
-  Electrified Opening

Hardware Group No. 01

For use on Door #(s):

100                      101

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224HD		628	IVE
2	EA	PUSH/PULL BAR	9190HD-10"-NO		630	IVE
1	EA	SURF. AUTO OPERATOR	9553 REG2 LESS TRACK MS AS REQ (120/240 VAC)		 ANCL R	LCN
1	EA	WEATHER RING	8310-801			LCN
1	EA	SWITCH	8310-806K			LCN
2	EA	ACTUATOR, TOUCH	8310-853T		 630	LCN
2	EA	MOUNT BOX	8310-867S			LCN
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O
1	EA	THRESHOLD	8655A-223		A	ZER
1	EA	POWER SUPPLY	PS902 900-4RL FA900 120/240 VAC		 LGR	SCE

DOORS ARE NORMALLY CLOSED AND UNLOCKED. MANAUL INGRESS AND EGRESS BY PULLING OR PUSHING DOORS OPEN. ASSISTED INGRESS AND EGRESS BY PUSHING ON ACTUATORS TO ENGAGE AUTO OPERATOR. KEYSWITCH IS USED TO TURN OPERATOR TO ON/OFF/ HOLD OPEN MODES.

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Hardware Group No. 02

For use on Door #(s):

101A            102

Provide each SGL door(s) with the following:





QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JCO6D RHO		626	SCH
1	EA	IC 6 PIN DISPOSABLE TEMPORARY CORE	8000-CT6D		626	C-R
1	EA	PERMANENT CORE	PROVIDED BY OWNER			C-R
1	EA	SURFACE CLOSER	4040XP HCUSH		689	LCN
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O

Hardware Group No. 02A

For use on Door #(s):

101B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JCO6D RHO		626	SCH
1	EA	IC 6 PIN DISPOSABLE TEMPORARY CORE	8000-CT6D		626	C-R
1	EA	PERMANENT CORE	PROVIDED BY OWNER			C-R
1	EA	SURFACE CLOSER	4040XP HCUSH		689	LCN
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O

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Hardware Group No. 02B

For use on Door #(s):

119

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80JCO6D RHO		626	SCH
1	EA	IC 6 PIN DISPOSABLE TEMPORARY CORE	8000-CT6D		626	C-R
1	EA	PERMANENT CORE	PROVIDED BY OWNER			C-R
1	EA	SURFACE CLOSER	4040XP H		689	LCN
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O








Hardware Group No. 03

For use on Door #(s):

105

106

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O

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Hardware Group No. 04

For use on Door #(s):

108                    110                    111                    112

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80JCO6D RHO		626	SCH
1	EA	IC 6 PIN DISPOSABLE TEMPORARY CORE	8000-CT6D		626	C-R
1	EA	ELECTRIC STRIKE	6211AL FS 12/16/24/28 VAC/VDC	 ↗	630	VON
1	EA	PERMANENT CORE	PROVIDED BY OWNER			C-R
1	EA	SURFACE CLOSER	4040XP		689	LCN
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING CARD READER - WORK OF DIVISION 28 POWER SUPPLY - WORK OF DIVISION 28			B/O


DOOR IS NORMALLY CLOSED AND LOCKED. PRESENTATION OF VALID CREDENTIAL TO READER WILL MOMENTARILY UNLOCK ELECTRIC STRIKE ALLOWING INGRESS. FREE EGRESS AT ALL TIMES.

Hardware Group No. 04A

For use on Door #(s):

110A                    111A

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	Sliding Door	EXAMSLIDE SYSTEM, SECTION 08 34 00			ADS
1	EA	THUMBTURN WITH INDICATOR AND PULL	ADA-2		626	ADS

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Hardware Group No. 05

For use on Door #(s):

109

Provide each SGL door(s) with the following:





QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JCO6D RHO		626	SCH
1	EA	IC 6 PIN DISPOSABLE TEMPORARY CORE	8000-CT6D		626	C-R
1	EA	PERMANENT CORE	PROVIDED BY OWNER			C-R
1	EA	SURFACE CLOSER	4040XP		689	LCN
1	EA	FLOOR STOP	FS439		682	IVE
			INSTALL CLOSE TO WALL AT HINGE EDGE OF DOOR			
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O

Hardware Group No. 06

For use on Door #(s):

112A                      114                      115

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JCO6D RHO		626	SCH
1	EA	IC 6 PIN DISPOSABLE TEMPORARY CORE	8000-CT6D		626	C-R
1	EA	PERMANENT CORE	PROVIDED BY OWNER			C-R
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O

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Hardware Group No. 07

For use on Door #(s):

117                      118

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
2	EA	MANUAL FLUSH BOLT	FB458		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	ND80JCO6D RHO		626	SCH
1	EA	IC 6 PIN DISPOSABLE TEMPORARY CORE	8000-CT6D		626	C-R
1	EA	PERMANENT CORE	PROVIDED BY OWNER			C-R
2	EA	SURFACE CLOSER	4040XP HCUSH		689	LCN
1	EA	BY DOOR/FRAME MFR.	BRUSH WEATHERSTRIPPING			B/O

END OF SECTION

## SECTION 088000

### GLAZING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Glazing units.
- B. Plastic sheet glazing units.
- C. Glazing compounds and accessories.

##### 1.02 RELATED REQUIREMENTS

- A. Section 081416 - Flush Wood Doors: Glazed lites in doors.

##### 1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- F. GANA (GM) - GANA Glazing Manual; 2008.
- G. GANA (SM) - GANA Sealant Manual; 2008.
- H. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- I. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

##### 1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

##### 1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

##### 1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

#### PART 2 PRODUCTS

##### 2.01 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
  - 1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
  - 2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.



## **2.02 GLAZING UNITS**

- A. Type G-2 - Monolithic Interior Vision Glazing:
  - 1. Applications: Interior glazing unless otherwise indicated.
  - 2. Glass Type: Fully tempered float glass.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch, nominal.

## **2.03 PLASTIC SHEET GLAZING UNITS**

- A. Acrylic Sheet:
  - 1. Application: Locations as indicated on drawings.
  - 2. Type: Monolithic (single layer solid) sheet.
  - 3. Ultraviolet stabilized.
  - 4. Tint: Clear.
  - 5. Thickness: 1/2 inch.

## **2.04 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
  - 1. Width: As required for application.
- C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- D. Glazing Clips: Manufacturer's standard type.

## **PART 3 EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

### **3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- B. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

### **3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

### **3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)**

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- F. Carefully trim protruding tape with knife.

### **3.06 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

### **3.07 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION 088000**

**SECTION 088300**  
**MIRRORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Glass mirrors.
  - 1. Annealed float glass.

**1.02 REFERENCE STANDARDS**

- A. ASTM C1036 - Standard Specification for Flat Glass; 2016.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

**1.04 FIELD CONDITIONS**

- A. Do not install mirrors when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

**1.05 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.
  - 1. Thickness: 1/4 inch.
  - 2. Size: As indicated on drawings.

**2.02 ACCESSORIES**

- A. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
  - 1. Application Temperature: Minus 35 to 140 degrees F at contact surfaces.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

**3.02 PREPARATION**

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

**3.03 INSTALLATION**

- A. Install mirrors in accordance with manufacturer's recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.

- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

**3.04 CLEANING**

- A. Remove labels after work is complete.
- B. Clean mirrors and adjacent surfaces.

**END OF SECTION 088300**

**SECTION 092116**  
**GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal stud wall framing.
- B. Metal channel ceiling framing.
- C. Acoustic insulation.
- D. Cementitious backing board.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

**1.03 REFERENCE STANDARDS**

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.
- J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2018.
- K. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.
- L. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2019.
- M. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- O. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

## **PART 2 PRODUCTS**

### **2.01 METAL FRAMING MATERIALS**

- A. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 10 psf.
  - 1. Studs: C-shaped with knurled or embossed faces.
  - 2. Runners: U shaped, sized to match studs, with G60/Z180 hot-dipped galvanized coating.
- B. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
  - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
  - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
- C. Non-structural Framing Accessories:
  - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
  - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.

### **2.02 BOARD MATERIALS**

- A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold resistant board is required in restrooms, except at ceramic tile, and within 3 feet of any plumbing fixture.
  - 3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
- B. Backing Board For Tile:
  - 1. Application: Surfaces behind tile in all areas including restrooms and lobbies.
  - 2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    - a. Thickness: 1/2 inch.

### **2.03 GYPSUM WALLBOARD ACCESSORIES**

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 inch.
- B. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
  - 1. Types: As detailed or required for finished appearance.
  - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
- C. Decorative Metal Trim:
  - 1. Material: Extruded aluminum alloy 6063-T5 temper.
  - 2. Finish: Anodized, clear.
  - 3. Type: Profile as selected from manufacturer's standard range.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners.
  2. Joint Compound: Drying type, vinyl-based, ready-mixed.
- E. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

### **3.02 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center.
  1. Extend partition framing to structure in all locations, unless otherwise indicated.
  2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

### **3.03 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### **3.04 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board.

### **3.05 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

### **3.06 JOINT TREATMENT**

- A. Paper Faced Gypsum Board: Use fiberglass joint tape, embed with drying type joint compound and finish with drying type joint compound.

- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

### **3.07 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

**END OF SECTION 092116**



## SECTION 093000

### TILING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Non-ceramic trim.

##### 1.02 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2017.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 2017.
- C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2016).
- D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017.
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2016).
- N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.
- O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).
- P. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

- Q. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
- R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.
- S. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
- T. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2019.
- U. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018.
- V. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- W. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- X. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2019.

### **1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, and thresholds.
- D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 1 percent of each size, color, and surface finish combination, but not less than 1 box of each type.

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

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

### **1.05 FIELD CONDITIONS**

- A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

## **PART 2 PRODUCTS**

### **2.01 TILE**

- A. Ceramic Mosaic Tile: ANSI A137.1, standard grade.
  - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  - 2. Size: 12 by 12 inch, nominal.
  - 3. Edges: Square.
  - 4. Surface Finish: Unglazed.
  - 5. Color(s): As indicated on drawings.
- B. Porcelain Tile: ANSI A137.1, standard grade.
  - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  - 2. Sizes: 8 by 48 inch, nominal; 24 x 24 inch, nominal; 12 x 24 inch, nominal.
  - 3. Thickness: 7/16 inch.
  - 4. Edges: Square.
  - 5. Surface Finish: Unglazed.
  - 6. Color(s): As indicated on drawings.

7. Trim Units: Matching bullnose shapes in sizes indicated.

## **2.02 TRIM AND ACCESSORIES**

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.

## **2.03 SETTING MATERIALS**

- A. Provide setting and grout materials from same manufacturer.
- B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

## **2.04 GROUTS**

- A. Provide setting and grout materials from same manufacturer.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
  1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  3. Color(s): As indicated on drawings.

## **2.05 ACCESSORY MATERIALS**

- A. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
  1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
  2. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber or Acrylic.
    - b. Thickness: 25 mils, minimum, dry film thickness.
- B. Membrane at Walls:
  1. Material: 4 mil thick polyethylene film.
- C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
- D. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
  1. Test as Follows:
    - a. Internal Relative Humidity: ASTM F2170.
    - b. Moisture Vapor Emission: ASTM F1869.
  2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

### **3.05 INSTALLATION - WALL TILE**

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

### **3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION 093000**

**SECTION 095100**  
**ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.02 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 4 by 4 inch in size illustrating material and finish of acoustical units.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

**1.04 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**PART 2 PRODUCTS**

**2.01 ACOUSTICAL UNITS**

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
  - 1. Classification: ASTM E1264 Type IV.
    - a. Form: 2, water felted.
    - b. Pattern: "E" - lightly textured.
  - 2. Sizes: 24 by 24 inches; 24 by 60 inches.
  - 3. Thickness: 1 inches.
  - 4. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
  - 5. NRC Range: 0.85 to 0.85, determined in accordance with ASTM E1264.
  - 6. Articulation Class (AC): 170, determined in accordance with ASTM E1264.
  - 7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
  - 8. Panel Edge: Tegular.
  - 9. Color: White.
  - 10. Suspension System: Exposed grid.
- C. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:

1. Application(s): Bathrooms.
  2. Classification: ASTM E1264 Type IV.
    - a. Form: 2, water felted.
    - b. Pattern: "E" - lightly textured.
  3. Size: 24 by 24 inches.
  4. Thickness: 5/8 inch.
  5. Light Reflectance: 78 percent, determined in accordance with ASTM E1264.
  6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
  7. Panel Edge: Square.
  8. Color: White.
  9. Suspension System: Exposed grid.
- D. Wood Veneer Acoustic Panels: Particle board core with wood veneer face and non-woven acoustical fabric backer.
1. Panel Size: 12 by 48 inches.
  2. Panel Thickness: 3/4 inch.
  3. Provide MDF with no added urea formaldehyde (NAUF).
  4. Perforated Panel: Pattern Round Straight.
  5. Edge Profile: Square Tegular.
  6. Suspension System: Exposed grid.

## **2.02 SUSPENSION SYSTEM(S)**

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, stabilizer bars, clips, and splices as required.
1. Materials:
    - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
  2. Profiles: Tee; 15/26 and 9/16 inch face width.
  3. Finish: Baked enamel.
  4. Colors: White at white tile ceilings. Match wood at wood tile ceilings.

## **2.03 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Wood Veneer Panel Safety Clips: Galvanized 1-9/16 by 5-1/2 inch bent sheet metal clips screw anchored to back of adjacent panels and spanning over top of suspended tee grid.
1. Wire Ties: No. 12 galvanized wire.
- D. Perimeter Moldings: Same metal and finish as grid.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 PREPARATION**

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

### **3.03 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

### **3.04 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.
  - 2. Double cut and field paint exposed reveal edges.
- F. Install safety clips on wood veneer panels 2 inches from outside edge of panel and at 24 inches on center.

### **3.05 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION 095100**

**SECTION 096500  
RESILIENT FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Resilient base.
- C. Resilient stair accessories.
- D. Installation accessories.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers; 1998 (Reapproved 2015).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).
- D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
- E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.
- F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- G. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).
- H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.
- J. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 100 square feet of each type and color.
  - 3. Extra Wall Base: 50 linear feet of each type and color.
  - 4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.



- E. Do not double stack pallets.

## **PART 2 PRODUCTS**

### **2.01 TILE FLOORING**

- A. Vinyl Tile: Printed film type, with transparent or translucent wear layer; acoustic interlayer or backing.
  - 1. Minimum Requirements: Comply with ASTM F1700, Class III.
  - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
  - 3. Mold and Microbial Resistance: Highly resistant when tested in accordance with ASTM D6329.
  - 4. Plank Tile Size: 6 by 48 inch.
  - 5. Wear Layer Thickness: 0.020 inch.
  - 6. Total Thickness: 0.120 inch.
  - 7. Color: As indicated on drawings.

### **2.02 STAIR COVERING**

- A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness.
  - 1. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
  - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
  - 3. Nosing: Square.
  - 4. Texture: Hammered.
  - 5. Color: As indicated on drawings.
- B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.
  - 1. Thickness: 0.080 inch.
- C. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
  - 1. Nominal Thickness: 0.080 inch.

### **2.03 RESILIENT BASE**

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
  - 1. Height: 4 inch.
  - 2. Thickness: 0.125 inch.
  - 3. Finish: Satin.
  - 4. Length: Roll.
  - 5. Color: As indicated on drawings.
  - 6. Accessories: Premolded external corners and internal corners.

### **2.04 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Filler for Coved Base: Plastic.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test as Follows:
    - a. Alkalinity (pH): ASTM F710.
    - b. Internal Relative Humidity: ASTM F2170.
    - c. Moisture Vapor Emission: ASTM F1869.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.
- E. Clean substrate.

### **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
  - 1. Fit joints and butt seams tightly.
  - 2. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
- E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
  - 1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

### **3.04 INSTALLATION - TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Install plank tile with a random offset of at least 6 inches from adjacent rows.

### **3.05 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.

### **3.06 INSTALLATION - STAIR COVERINGS**

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Install stringers configured tightly to stair profile.
- C. Adhere over entire surface. Fit accurately and securely.

**3.07 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

**3.08 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION 096500**

**SECTION 096813**  
**TILE CARPETING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.

**1.02 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

**1.04 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Tile Carpeting: Tufted Textured Loop, manufactured in one color dye lot.
  - 1. Tile Size: 19.69 by 19.69 inch, nominal.
  - 2. Traffic Classification: Severe.
  - 3. Colors: As indicated on the drawings.
  - 4. Color System: Solution Dyed.
  - 5. Pattern: As indicated on the drawings.
  - 6. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
  - 7. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  - 8. Stitches: 10.50 per inch.
  - 9. Pile Weight: 18.00 oz/sq yd.
  - 10. Pile Density: 6,821.00 ounces per cubic yard.
  - 11. Pile height: 0.13 inches.
  - 12. Pile Thickness: 0.10 inches.
  - 13. Primary Backing Material: Vinyl.

## **2.02 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum, \_\_\_\_\_ color.
- C. Adhesives:
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test as Follows:
    - a. Internal Relative Humidity: ASTM F2170.
    - b. Moisture Vapor Emission: ASTM F1869.
  - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

### **3.02 PREPARATION**

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Vacuum clean substrate.

### **3.03 INSTALLATION**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in indicated pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

### **3.04 CLEANING**

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION 096813**

**SECTION 096816**  
**SHEET CARPETING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Carpet, Walk-Off.

**1.02 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- C. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional requirements.
  - 2. Extra Carpet: One extra walk-off carpet

**PART 2 PRODUCTS**

**2.01 CARPET**

- A. Carpet: Needlebond Rib, Pet Polyester.
  - 1. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
  - 2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  - 3. VOC Content: Provide CRI (GLP) certified product; in lieu of labeling, independent test report showing compliance is acceptable.
  - 4. Color: As indicated on the drawings.
  - 5. Pattern: As indicated on the drawings.
  - 6. Roll Width: 12 ft.
  - 7. Stitches: 0.0 per inch.
  - 8. Finished Pile Thickness: 0.344 inch.
  - 9. Primary Backing:
    - a. Material: Polypropylene.
  - 10. Secondary Backing:
    - a. Material: Rubber.
  - 11. Tufted Weight: 51.0 oz/sq yd.
  - 12. Total Thickness: 0.458 inch.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

**3.02 PREPARATION**

- A. Clean substrate.

### **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Verify carpet match before cutting to ensure minimal variation between dye lots.
- C. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

### **3.04 CLEANING**

- A. Clean and vacuum carpet surfaces.

**END OF SECTION 096816**

**SECTION 099123**  
**INTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Mechanical and Electrical:
    - a. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Glass.
  - 9. Acoustical materials, unless specifically indicated.
  - 10. Concealed pipes, ducts, and conduits.

**1.02 REFERENCE STANDARDS**

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- C. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.



- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

### **1.05 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
  1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  3. Supply each paint material in quantity required to complete entire project's work from a single production run.
  4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

### **2.03 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, uncoated steel, shop primed steel, and galvanized steel.
  1. Two top coats and one coat primer.
  2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
  3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    - b. Eggshell: MPI gloss level 3; use this sheen at all locations, unless otherwise noted.
    - c. Semi-Gloss: MPI gloss level 5; use this sheen at all metal items.
  4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
  1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
  2. Two top coats and one coat primer.
  3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
  4. Top Coat Sheen:

- a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

## **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

- F. Sand metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

**3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**3.05 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION 099123**

## SECTION 101400

### SIGNAGE

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Room and door signs.

##### 1.02 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. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

##### 1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
  - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Curved Sign Media Suction Cups: One for each 100 signs; for removing media.

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

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.

#### PART 2 PRODUCTS

##### 2.01 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 2017, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway in the project scope area, whether it has a door or not, not including corridors, lobbies, and similar open areas.
  - 1. Sign Type: Curved signs with engraved panel media as specified.
  - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
  - 3. Character Height: 1 inch.
  - 4. Sign Height: 3 inches, minimum, unless otherwise indicated.
  - 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
  - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.

7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.

## **2.02 SIGN TYPES**

- A. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
  1. Finish: Natural (clear) anodized.
  2. Sign Orientation: Curved in horizontal section.
  3. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.
  4. Directories: For customer-produced media; provide divider strips.
- B. Color and Font: Unless otherwise indicated:
  1. Character Font: Helvetica, Arial, or other sans serif font.
  2. Character Case: Upper case only.
  3. Background Color: Clear.
  4. Character Color: Contrasting color.

## **2.03 TACTILE SIGNAGE MEDIA**

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
  1. Total Thickness: 1/16 inch.

## **2.04 ACCESSORIES**

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**END OF SECTION 101400**

**SECTION 102113.19**  
**PLASTIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Solid plastic toilet compartments.
- B. Urinal and vestibule screens.

**1.02 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications: Concealed steel support members.
- B. Section 061000 - Rough Carpentry: Blocking and supports.

**1.03 REFERENCE STANDARDS**

- A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 4 x 4 inch in size illustrating panel finish, color, and sheen.

**PART 2 PRODUCTS**

**2.01 PLASTIC TOILET COMPARTMENTS**

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; ceiling-hung.
  - 1. Color: As indicated on the drawings.
  - 2. Doors:
    - a. Thickness: 1 inch.
    - b. Width: 24 inch.
    - c. Width for Handicapped Use: 36 inch, out-swinging.
    - d. Height: 55 inch.
  - 3. Panels:
    - a. Thickness: 1 inch.
    - b. Height: 55 inch.
  - 4. Pilasters:
    - a. Thickness: 1 inch.
    - b. Width: As required to fit space; minimum 3 inch.
  - 5. Screens: Without doors; to match compartments; mounted to wall with 3 panel brackets.

**2.02 ACCESSORIES**

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing ceiling fastenings.
  - 1. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.
- B. Head Rails: Extruded aluminum,.
  - 1. Size: Manufacturer's standard size.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

- E. Hinges: Stainless steel, manufacturer's standard finish.
  - 1. Continuous-type hinge, self closing.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
  - 1. Door Latch: Slide type with exterior emergency access feature.
  - 2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
  - 3. Provide door pull for outswinging doors.
- G. Toilet Partition Suspension Members: As specified in Section 055000.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

#### **3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

#### **3.03 TOLERANCES**

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

#### **3.04 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

**END OF SECTION 102113.19**

**SECTION 104400**  
**FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

**1.02 REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.

**PART 2 PRODUCTS**

**2.01 FIRE EXTINGUISHERS**

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Stored Pressure Operated: Deep Drawn.
  - 2. Class: A:B:C type.
  - 3. Size: 10 pound.
  - 4. Finish: Baked polyester powder coat, red color.
  - 5. Temperature range: Minus 40 degrees F to 120 degrees F.

**2.02 FIRE EXTINGUISHER CABINETS**

- A. Cabinet Construction: Non-fire rated.
  - 1. Formed primed steel sheet; 0.036 inch thick base metal.
- B. Cabinet Configuration: Semi-recessed type.
  - 1. Size to accommodate accessories.
  - 2. Trim: Flat square edge, with 3 inch wide face.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Fabrication: Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
- H. Finish of Cabinet Interior: White colored enamel.

**2.03 ACCESSORIES**

- A. Lettering "FIRE EXTINGUISHER" decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).



## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 48 inches max from finished floor to handle of the fire extinguisher.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

**END OF SECTION 104400**

**SECTION 123600  
COUNTERTOPS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.

**1.02 RELATED REQUIREMENTS**

- A. Section 064100 - Architectural Wood Casework.
- B. Section 123100 - Manufactured Metal Casework.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- D. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- F. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- G. PS 1 - Structural Plywood; 2009.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

**1.05 DELIVERY, STORAGE, AND HANDLING**

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

**PART 2 PRODUCTS**

**2.01 COUNTERTOPS**

- A. Quality Standard: See Section 123100.
- B. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
  - 1. Flat Sheet Thickness: 1-1/4 inch, minimum.
  - 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments;

homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.

- a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
  - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
  - c. Finish on Exposed Surfaces: Polished.
  - d. Color and Pattern: As indicated on drawings.
3. Other Components Thickness: 3/4 inch, minimum.
  4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
  5. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

## **2.02 MATERIALS**

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

## **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  1. Join lengths of tops using best method recommended by manufacturer.
  2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.

**3.04 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

**3.05 CLEANING**

- A. Clean countertops surfaces thoroughly.

**3.06 PROTECTION**

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

**END OF SECTION 123600**

**SECTION 221116  
WATER DISTRIBUTION PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section specifies water distribution piping system, including potable cold, and hot water piping, fittings, and specialties within the building.

**1.2 EXTRA STOCK**

- A. Maintenance Stock: Furnish to Owner one valve key for each key operated fixture supply or faucet installed.

**PART 2 - PRODUCTS**

**2.1 PIPE AND FITTINGS**

A. Pipe within Building:

- 1. Pipe Sizes 4" and Smaller: Copper tubing. Conform to ASTM B88, Type L, hard temper copper tube; ANSI B16.22 streamlined pattern wrought-copper fittings, with soldered joints using lead-free solder (or wrought copper and bronze grooved-end fittings, piping 2-1/2" to 6"; ASTM B75 tube and ASTM B584 bronze castings).

**2.2 VALVES**

A. Shut Off Valves

- 1. Manufacturers: Conbraco 70-120-04, Watts B6080, NIBCO Inc. T-585-70.
- 2. General: MSS SP-110.
- 3. Two-Piece; ASTM B 584: Bronze body and stem with full-port, chrome-plated solid bronze ball; TFE seats; 600-psig minimum CWP rating and blowout-proof stem; non-thermal conductive material extended handle valve with vapor seal and protective sleeve.

- B. Water Tempering Valve: (Public Handwashing Lavatories): Valve body construction shall be brass and bronze with brass and stainless steel flow control components; 360° handle adjustment for temperature selection; vandal resistant lockable handle; unit shall be complete with separate check valves and thermometer. Discharge temperature shall be adjustable to within 10° F. of inlet water temperature at 0.5 minimum flow. Unit shall be certified to ASSE 1070 and meet the anti-scald requirements of ASSE 1016. Symmons Maxiline Model 7-210 for (1) lavatory or approved equal.

**2.3. SPECIALTIES**

- A. Hose Bibbs in Restrooms: Bronze body, renewable composition disc, tee handle, 3/4" solder inlet, 3/4" hose outlet and brass hose connection with vacuum breaker (ASSE 1011). JR Smith 5618.

## **PART 3 - EXECUTION**

### **3.1 JOINING PIPES AND FITTINGS**

- A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1 for piping (or in sizes 2-1/2" to 6"), above ground, within building, (tubing with roll-grooved ends and mechanical couplings).

### **3.2 PIPING INSTALLATION**

- A. Refer to the separate Division 23 section: Basic Piping Materials and Methods, for general piping installation instructions.
- C. Install piping with 1/32" per foot (1/4 percent) downward slope towards drain point.

### **3.3 INSTALLATION OF VALVES**

- A. Installation requirements for general duty valves are specified in a separate section of Division 23.
- B. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2" and smaller, use ball valves; for sectional valves 2-1/2" and larger, use butterfly valves.
- C. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2" and smaller, use ball valves; for shutoff valves 2-1/2" and larger, use butterfly valves.
- D. Drain Valves: Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair, at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system. Drain consists of a tee fitting, 3/4" ball valve and short 3/4" threaded nipple and cap with chain; Nibco T-585-70-HC or approved equal.
- E. Water Tempering Valves: Install on piping where indicated and as per manufacturer's instructions.

### **3.4 EQUIPMENT CONNECTIONS**

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Virginia Uniform Statewide Building Code.

### **3.5 FIELD QUALITY CONTROL**

- A. Inspections:
  - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction (AHJ).
  - 2. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
  - 3. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
  - 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Piping System Test:
  - A. Test for leaks and defects in all new water distribution piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
  - B. Cap and subject the piping system to a static water pressure of 125 psig without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
  - C. Prepare reports for all tests and required corrective action.

### **3.6 ADJUSTING AND CLEANING**

- A. Cleaning and Disinfecting:
  - 1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
  - 2. Use the purging and disinfecting procedure as described below:
  - 3. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
  - 4. Disinfecting of potable water systems as per method described by VUSB Code.
- B. Prepare reports for all purging and disinfecting activities.
- C. All bacteriological reports and laboratory testing of the potable water shall be complete and approved by the local Public Health office at the time of the substantial completion inspection.

**END OF SECTION**

**SECTION 221316  
DRAINAGE AND VENT SYSTEMS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section specifies soil, waste and vent systems; storm drainage systems; and related specialties within the building and (to a point 5 feet) outside the building (as indicated).

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Cast Iron Soil Pipe: ASTM A74, bearing the CI collective trademark and listed by NSF International.
- B. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:
- C. Drainage Piping Specialties, including backwater valves, cleanouts and drains: Josam Mfg. Co.; Smith Mfg. Co.; Zurn Industries Inc.
- D. Non-Metallic Trench Drains: Smith ACO Mfg. Co.; Quazite Corp.

**2.2 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS**

- A. Cast iron soil pipe: Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, bearing the CI collective trademark, and listed by NSF International, with neoprene compression gasket joints conforming to ASTM C1277 and CISPI 310 and listing by NSF International.
- B. Hubless cast iron soil pipe: Conform to ASTM Standard A888, and CISPI 301, bearing the CI collective trademark, and listed by the NSF International, cast iron soil pipe and fittings, stainless steel shield-clamp assembly with neoprene sleeve conforming to CISPI Standard 310 and listed by NSF International.

**2.3 UNDERGROUND BUILDING DRAINAGE PIPE AND FITTINGS**

- A. Cast iron soil pipe: Conform to ASTM A74, bearing the CI collective trademark and listed by NSF International, for service weight, hub-and-spigot soil pipe and fittings, with neoprene compression gasket joints conforming to ASTM C564 and CISPI 310 and listed by NSF International. Pipe and fittings shall be provided with coating in conformance with ASTM A74.

**2.4 DRAINAGE PIPING SPECIALTIES**

- A. Cleanout Plugs: Cast bronze or brass, threads complying with ANSI B2.1, countersunk head.



- B. Floor Cleanouts: Cast iron body and frame, with cast bronze or brass cleanout plug and adj. round top as follows:
  - 1. Nickel-Bronze Top (Finished Areas): Manufacturer's standard cast unit with the following patterns: Exposed flush type, standard non-slip scored finish. Note: For carpeted floors, provide (suffix "X" carpet clamping frame). Josam 56010-22; Smith 4023; Zurn 1400-2.
- C. Wall Cleanouts: Cast iron body adaptable to pipe with cast bronze or brass cleanout plug; stainless steel cover including S.S. screws; Josam 58790-22; Smith 4532; Zurn 1445-1.

## **PART 3 - EXECUTION**

### **3.1 TRENCHING, BEDDING AND BACKFILLING:**

- A. Trench excavation: Trenching shall be in accordance with VUSB Code. Care shall be taken not to over excavate. Any portion of trench that is overexcavated shall be refilled to proper grade with crushed stone or sand as specified for bedding below. Excavation involving thermoplastic pipe shall be done in accordance with ASTM D2321.
- B. Pipe Bedding: Where trenches are excavated below grade such that the bottom of trench does not form the bed for the pipe, the trench shall be backfilled to grade with clean sand or VDOT size 68 or 78 crushed stone and hand tamped to 95% compaction. Backfill around sewer piping and to depth of at least 6" over the top of pipe with clean sand or VDOT size 68 or 78 crushed stone. Backfill shall be carefully and completely hand tamped to 95% compaction when tested in accordance with ASTM D-698. Pipe bedding involving thermoplastic pipe shall be done in accordance with ASTM D2321.
- C. Backfilling: Backfill sewer piping to 12" over top of pipe with clean sand or VDOT size 68 or 78 crushed stone and hand tamp to 95% compaction. Complete backfilling of trench using earth free from stones and debris and compact in layers not exceeding 6" in thickness. Compact the remainder of the trench thoroughly with tampers. Backfilling involving thermoplastic pipe shall be done in accordance with ASTM D2321.

### **3.2 JOINING PIPES AND FITTINGS:**

- A. Cast Iron Soil Pipe: Make compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV. All couplings for hubless cast iron soil pipe shall conform to CISPI 310 and be certified by NSF International.

### **3.3 INSTALLATION:**

- A. Refer to the separate Division 23 section: Basic Piping Materials and Methods, for general piping installation instructions.
- B. Install supports and anchors in accordance with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors".

- C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-plies, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- E. Install underground building drains to conform with the plumbing code, and in accordance with ASTM D2321 for plastic drainage piping or with the Cast Iron Soil Pipe Institute Cast Iron Soil Pipe and Fittings Handbook. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in lines and pull past each joint as it is completed.
- F. Install building drain pitched down at minimum slope of 1/4" per foot (2 percent) for piping (2-1/2") and smaller, and 1/8" per foot (1 percent) for piping 3" and larger.

### **3.4 COMPACTION:**

- A. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D-698 Standard Proctor.
- B. Under structures, building slabs and steps: Compact top 12" of subgrade to 100% and extending 10' outside the structure. Backfill and fill material below the top 12" layer shall be compacted to 95%.

### **3.5 INSTALLATION OF PIPING SPECIALTIES:**

- A. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and as required by plumbing code; at each change in direction of piping greater than 45 degrees; at minimum intervals of 100'; at base of each vertical soil or waste stack.
- B. Cleanouts Covers: Install wall cleanout covers for concealed piping.

### **3.6 CONNECTIONS:**

- A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

### **3.7 FIELD QUALITY CONTROL:**

- A. Inspections:
  - 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
  - 2. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
  - 3. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
  - 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Piping System Test:
  - 1. Test for leaks and defects in all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
  - 2. Drainage and Vent System Testing Procedures shall be in accordance with VUSB Code. Prepare reports for all tests and required corrective action.

### **3.8 ADJUSTING AND CLEANING:**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

### **3.9 PROTECTION:**

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

**END OF SECTION**

**SECTION 2240000**  
**PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section specifies plumbing fixtures and trim. The types of fixtures specified include the following:
1. Lavatories (including handicap type);
  2. Water Closets (including handicap type);
  3. Urinals (including handicap type);
  4. Wall Mounted Water Coolers (including handicap type);
  5. Faucets;
  6. Flush Valves;
  7. Toilet Seats;
  8. Fittings, Trim, and Accessories.

**1.2 RELATED DOCUMENTS**

- A. Division-23 Basic Materials and Methods sections apply to work of this section.
- B. Related Sections:
1. Separate grab bars and toilet accessories not an integral part of plumbing fixtures are specified in Division 10.

**1.3 QUALITY ASSURANCE**

- A. Codes and Standards:
1. ARI Standard 1020: "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking Water Coolers".
  2. ICC/ANSI Standard A117.1-2009: "Accessible and Usable Buildings and Facilities".
  3. 2010 ADA Standards for Accessible Design, September 15, 2010.
  4. UL Standard 399: "Drinking-Water Coolers".

**1.4 SUBMITTALS**

- A. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division 6 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.
- B. Color Charts: Submit manufacturer's standard color charts for cabinet finishes and fixture colors.

## 1.5 MAINTENANCE

### A. Extra Stock:

1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer uniformity shall be as specified in Section 230000: Basic Mechanical Requirements under Product Options.
- B. Subject to compliance with specified requirements, provide plumbing fixtures of one of the following:
  1. Lavatories, Water Closets, Urinals: American Standard Inc.; Kohler Co.; Sloan; Toto.
  2. Faucets: American Standard Inc.; Chicago Faucet Co.; Bradley Corp.; Kohler Co.; Speakman Co.; Symmons Industries, Inc.; T&S Brass and Bronze Works; Sloan.
  3. Flush Valves: Kohler, Coyne & Delany Co.; Sloan Valve Co.; Zurn Industries, Inc.
  4. Water Closet Seats: Bemis Mfg. Co.; Beneke Corp.; Kohler; Church Seat Co.
  5. Water Coolers: Elkay Mfg. Co.; Halsey Taylor Div.; Haws Drinking Fountain Co.; Acorn Engineering Co.

### 2.2 FIXTURES:

- P-1 Water Closets: vitreous china, back outlet, wall hung, (1.6 gal./flush), siphon action elongated closet bowl, with 1-1/2" top spud; quiet flushing action, with self-draining jets and large passageway and with fittings and gasket seal. Reuse concealed wall fixture support. Provide seat, and flush valve (FV-1) as specified in the Articles below; A-S 2257.001; Sloan ST-2059-A; Toto CT708U; or Kohler K-84325. Mount rim 15" A.F.F.
- P-2 Water Closets (Handicap): Same equipment as P-1 Water Closet above, except mount rim at handicap height, 17" A.F.F. NOTE: Controls for flush valves shall be mounted on the wide side of toilet areas to comply with ADA Standards.
- P-3 Urinals (Handicap): Vitreous china, siphon jet water saver 1.0 gal/flush, wall urinal with integral extended shields, elongated flush rim and trap, 3/4" top spud, 2" I.P.S. female outlet connection, supporting hanger and gasket seal. Reuse concealed wall fixture support. Provide flush valve Type "FV-2" as specified in the Articles below; A-S 6561.017; Toto UT447E; Sloan SU-1006; or Kohler K-4989-T. Mount lip 17" A.F.F.
- P-4 Counter Lavatory: 20" x 17" vitreous china undermount, oval countertop lavatory with off center drain and with front overflow. Drill countertop for faucet on 4" centers. Provide "Type-A" faucet, drain, trap, supplies and stops as specified in the Articles below; A-S 0496.221; Toto LT569; Sloan SS-3001; or Kohler K-2211.

P-5 Water Coolers - Wall Mounted - Bi-Level Combo (Regular & Handicap):

Electrical Characteristics: 115v/1ph/60 Hz, 3.7 amp., 1/5 HP, provide 3-prong power lead-in cord.

Capacity: 8.0 GPH of 50°F. drinking water, with ambient temperature of 90°F., and 80°F. entering water temperature.

Equipment: Provide bottle filler on lower unit, trap, supply and stop as specified in the Articles below for lavatories and sinks. Unit shall be in accordance with ICC/ANSI Standard A117.1-03. Mount lower unit at handicap height.

Manufacturer: Oasis PG8ACSL Combo with Cane 035174-001 apron for upper unit; Elkay EZSTLG8WS Combo with LKAPREZL apron for upper unit. Murdock A172108F-UG w/ BF12-BCD Bottle Filler. NOTE: Cane apron is not required when unit is installed in an alcove or wing walls are installed.

**2.3 WATER COOLERS:**

- A. Units shall be factory assembled and tested, listed and labeled in compliance with UL Standard 399, and accordance with ASHRAE Standard 18, and ARI Standard 1020.
- B. Cabinet: heavy gage, welded steel cabinet, with removable vinyl-on-steel front and side panels and hanger bracket for wall mounting. Cabinet finish and vinyl color as selected by the Architect.
- C. Top/Receptor: radius front, anti-splash ridge, smoothly contoured S.S. with raised bubbler mount, C.P. brass strainer, and 1¼" tailpiece.
- D. Bubbler and Valve: C.P. brass, auto. stream control lever handle/push-button valve with bubbler designed to provide uniform stream without spurting.
- E. Bubbler and Valve: C.P. brass bubbler valve housing with flexible nozzle guard with auto. stream control designed to provide uniform stream without spurting. Valve is activated by pressure exerted on touch pads located at front and sides of cooler.
- F. Refrigeration System: Non-ozone depleting refrigerant HFC-134a, hermetically sealed, capillary tube. All joints silver soldered.
- G. Compressor: hermetically sealed, with automatic reset overload protection.
- H. Condenser: air-cooled.
- I. Cooling Unit: tube type, self-cleaning, continuous coil of seamless cooper.
- J. Temperature Control: thermostat with adj. range of 42°F. to 53°F.
- K. Note: Provide foam tube insulation on piping connecting to non-refrigerated combo unit.

## 2.4

### FAUCETS:

- A. Lavatory Faucet (Type-A): Provide polished C.P. brass body, sensor activated, hard wired electronic 4" center set faucet with vandal resistant spray head, pressure compensating flow control, sensor range adjustment screw, spout and C.P. 0.5 gpm flow aerator, provide C.P. cast brass grid drain plug with strainer and with 1¼" x 6" C.P. 17 ga. tailpiece. Faucets shall have ANSI/NSF Certification of Compliance to Section 9 of Standard 61, Drinking Water Systems Components. Note: Provide off-set grid drain plug and 17 ga. C.P. tailpiece at Handicapped Lavatories. or A/S 605B.205 with PK00HAC transformer or Kohler K13462cp with k-13480a or 13481-A. EL Transformer will operate up to (6) faucets and PK up to 15 faucets. Install in accordance with manufacturer's installation requirements. See electrical drawings for transformer locations. TRANSFORMER MUST BE CONCEALED IN WALL IN JBOX. PLUG IN TRANSFORMERS ARE NOT ACCEPTABLE. Provide all wiring between valve and transformer.

## 2.5

### FLUSH VALVES:

- A. Hard wired sensor operated: Provide quiet, sensor operated 0.125 GPF polished chrome plated flush valve with I.P.S. screw driver combination angle stop and check valve with protective cap, adjustable tailpiece, vacuum breaker, flush connection and spud coupling for top spud flanges, Sloan Model ECOS 186-0, 125 OR A/S 606B.121 for water closets or A/S 6063.013 with PK00HAC for urinals. Provide Sloan EL-451 remote box mount 120 VAC input/6 VAC output 25VA transformer or A/S PK00HAC transformer. Note: One EL-451 will power up to 6 valves and one PK will power up to 15 valves. TRANSFORMER MUST BE CONCEALED IN WALL IN JBOX. PLUG IN TRANSFORMERS ARE NOT ACCEPTABLE. Provide all wiring between valve and transformer.
- B. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM alloy classification for red brass or semi-red brass. Valve shall be in compliance with Fed. Spec. WWP-541, Mil Spec. V-29193, ANSI 112.19.6 and ASSE 1037.
- C. Flush Valve (FV-1): Provide 1" I.P.S. closet flush valve for 1½" top spud flanges. A-S 6047.121
- D. Flush Valve (FV-2): Provide ¾" I.P.S. urinal flush valve for ¾" top spud flanges. A-S 6045.525.

## 2.6

### FITTINGS, TRIM, AND ACCESSORIES:

- A. Toilet Seats: elongated, solid white commercial weight plastic, closed profile back/open front, less cover, and having S.S. posts, washers, nuts & self-sustaining feature, check hinges and integral bumpers.
- B. Supplies and Stops for Lavatories and Sinks: polished C.P., loose-keyed angle stop having 1/2" inlet and 3/8" O.D. x 12" long annealed copper vertical tubing outlet, 1/2" x 5" C.P. threaded brass nipples or 1/2" nom. x 5" C.P. swt. copper tube, and wall flange or escutcheon.

- C. Supplies and Stops for Water Closets: polished C.P., loose-keyed angle stop having 1/2" inlet and 3/8" O.D. x 12" long annealed copper vertical tubing outlet with collar, 1/2" x 5" C.P. threaded brass nipples or 1/2" nom. x 5" C.P. swt. copper tube, and wall flange or escutcheon.
- D. Continuous Waste for Sinks: polished C.P., tubular brass, 17 ga., with brass nuts on slip inlets and of configurations indicated.
- E. Traps for Lavatories and Sinks: semi-cast brass, 17 ga. polished C.P., adj. "P" trap with cleanout and waste to wall. Trap size as per rough-in schedule.
- F. Escutcheons: C.P. one piece sheet steel with friction clips.
- G. Insulation Kit: Handicap lavatory and sink insulation system for P-trap and angle valve assemblies shall be insulated with the fully molded closed cell vinyl, TRUEBRO light gray color insulation kit, Model #102 with 3-piece interlocking trap assembly and 2-piece interlocking angle valve assemblies; Pro-Wrap; or Plumberex. Fasteners shall be nylon-type supplied with kit. Burning characteristics conform to ASTM D635 and thermal conductivity conforms to ASTM C 177. Note: Not required where Architect is providing removable shielding panels.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION:**

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION:**

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- B. Comply with the installation requirements of ICC/ANSI A117.1 (2010 ADA Standards for Accessible Design, September 15, 2010) with respect to plumbing fixtures for the physically handicapped.
- C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- D. Install a stop valve in an accessible location in the water connection to each fixture.



- E. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.
- F. Seal fixtures to walls and floors using silicone sealant as specified in Section 07900. Match sealant color to fixture color.

**3.3 FIELD QUALITY CONTROL:**

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
- B. Inspect each installed unit for damage. Replace damaged fixtures.

**3.4 ADJUSTING:**

- A. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow and stream.
- B. Replace washers of leaking or dripping faucets and stops.

**3.5 CLEANING:**

- A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

**3.6 PROTECTION:**

- A. Provide protective covering for installed fixtures, water coolers, and trim.
- B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

**END OF SECTION**

**SECTION 230000  
BASIC MECHANICAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this and all other sections of Division 15.

**1.2 WORK INCLUDED:**

- A. All labor, materials, appliances, equipment, tools, transportation, superintendence, and services necessary for and reasonably incidental to execution of a complete mechanical system for the building areas shall be provided as herein specified and as indicated. All minor equipment, piping, valves, connections, specialties and appurtenances required to complete the systems and necessary to their proper operation, shall be provided.

**1.3 QUALITY ASSURANCE:**

- A. Codes and Standards:
  - 1. Virginia Statewide Building Code Compliance: Comply with applicable requirements of Virginia Statewide Building Code.
  - 2. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publications pertaining to raceways.
  - 3. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards.
  - 4. NEC Compliance: Comply with applicable requirements of National Electric Code.

**1.4 INTENT:**

- A. Where any specific materials, process, or method of construction, or manufactured article is specified by name or by reference to the catalogue number of a manufacturer, the specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance. Contractor shall verify the duty and performance with the specific characteristics of the equipment offered for installation.
  - 1. Conflicts between model numbers and performance requirements shall be resolved before submitting shop drawings. Failure to do so may result in Contractor having to remove and replace, at his expense, this work.

**1.5 REQUIREMENTS FOR BIDDERS**

- A. Contractor shall examine the drawings relating specifically to this work and assume responsibility for the proper fitting of the material and equipment in the building as indicated with the existing clearances; examine the drawings and specifications relating to the work of all trades; become fully informed as to the extent and character of all other work; visit the site;

make arrangements to avoid conflicts and interference with other features of construction and fully coordinate all components of this system so that they can be installed in proper relationship to other work and to the best interest of Owner.

1. The Drawings are to be considered diagrammatic, not necessarily showing in detail or scale all minor items. Unless specific dimensions are shown, the structural, architectural and site conditions shall govern the exact locations. Contractor shall follow drawings in laying out work, check drawings of trades to verify spaces in which work will be installed and maintain maximum head room, and space conditions at all points. Where head room, or space conditions appear inadequate, Engineer shall be notified before proceeding with installation. This Contractor shall, without extra charge, make field modification in layout as needed to prevent conflict with work of various trades or proper execution of the work.
2. Examine all drawings carefully prior to submitting a bid. Contractor will be required to furnish, install and or connect with appropriate services all mechanical items shown on mechanical drawings without additional expenses to the Owner. If discrepancies, conflicts, interferences or omissions occur between drawings, notify in writing the Engineer in ample time to permit revisions before the bids are submitted.

#### **1.6 PRODUCT SUBSTITUTIONS:**

- A. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.
- B. Provide products which are compatible within systems and other connected items.
- C. Where Contractor proposes to use any item of equipment other than that indicated which requires any redesign of the structure, partitions, foundations, piping, ductwork, wiring, or of any other part of the electrical, mechanical or architectural layout, all such redesign, and all new drawings and detailing required therefore, shall, be approved by Engineer, and shall be prepared by Contractor at his own expense.
- D. Where such approved deviation requires a different quantity and/or arrangement of ductwork, piping, wiring, conduit and equipment from that specified or indicated, Contractor shall provide same at no additional cost to Owner subject to approval by Engineer. Contractor requesting the change shall notify all trades involved and receive from the affected contractors a statement approving the deviation; failure to secure this approval shall subject Contractor requesting the deviations to all back charges rendered by the other affected Contractors.

#### **1.7 RULES, PERMITS AND FEES**

- A. Contractor shall give all necessary notices, pay all connection fees; obtain and pay for all permits; file all necessary drawings; prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required Certificates

of Inspection for his work and deliver same to Engineer before request for acceptance and final payment for the work.

## **1.8 MATERIAL AND WORKMANSHIP**

- A. Unless specified otherwise hereinafter, all materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind of quality of material is given, a first-class standard article as approved by Engineer shall be furnished. All work shall be performed in a neat and workmanlike manner by mechanics specially trained in the trade involved.
- B. Unless otherwise specifically indicated on the drawings, or in the specifications, all equipment and materials shall be applied subject to approval of Engineer, in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

## **1.9 UTILITY SERVICES**

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
  - 1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

## **1.10 RECORD DOCUMENTS**

- A. Prepare record documents to indicate the following installed conditions:
  - 1. Ductwork mains and branches, size and location.
  - 2. Mains and branches of piping systems, with valves and control devices located.
  - 3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

## **1.11 MAINTENANCE MANUALS**

- A. Prepare maintenance manuals to include the following information for equipment items:
  - 1. Copy of specification section and reviewed shop drawing relating to each equipment item.
  - 2. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  - 3. Manufacturer's printed installation instructions and application data.

4. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassemble; aligning and adjusting instructions.
6. Servicing instructions and lubrication charts and schedules.

#### **1.12 DEMOLITION**

- A. Protect existing mechanical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed mechanical equipment and installation, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove pipes and ducts, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation or reuse. Verify operation and performance before relocation.
- F. Air devices, sprinkler heads, and etc., located in existing ceilings being replaced with new ceiling at a different height, shall be raised or lowered as required to suit new location. Refer to Architectural Drawings for ceiling work.

#### **1.13 CUTTING AND PATCHING**

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

#### **1.14 REFINISHING AND TOUCHUP PAINTING**

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting".
  1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.
5. Existing air devices in ceilings to remain shall be cleaned and restored to like new condition.

#### **1.15 CLEANING AND PROTECTION**

- A. On completion of installation inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings and finishes are without damage or deterioration at time of Substantial Completion.

### **PART 2 - PRODUCTS**

**NOT APPLICABLE**

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of site improvements, utilities, mechanical systems, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  1. Before construction, verify the location and points of connection of utility services.
  2. Start of work by Contractor shall be considered as acceptance by him of all claims or questions as to suitability of the work of other trades or other Contractors to receive his work. This Contractor shall remove and replace, at his expense, all HVAC work which may have to be removed because of interference with other trades.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  1. Written Report: Prepare a written report listing conditions detrimental to performance of the Work, include the following:

- a. Description of the Work.
  - b. List of detrimental conditions, including substrates.
  - c. List of unacceptable installation tolerances.
  - d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes.
  3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  5. Examine ceiling plenum clearances for suitable space to install mechanical and electrical systems as indicated.
  6. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  1. Notify Architect not less than seven days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Architect's written permission.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### **3.3 INSTALLATION**

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
- G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### **3.4 STARTING AND ADJUSTING**

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### **3.5 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### **3.6 CORRECTION OF THE WORK**

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.



### **3.7 ROUGH-IN**

- A. Verify final locations and sizes for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

### **3.8 ACCESS DOORS**

- A. Furnish to General Contractor wall and ceiling access panels and doors where equipment is concealed behind finished surfaces and where indicated. Access panel and door types are specified in Division 8 "ACCESS DOORS".

### **3.9 SCHEDULE OF VALUES**

- A. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum. Minimum breakdown is as follows:
- B. Plumbing:
  - 1. Water distribution piping.
  - 2. Drainage and vent piping.
  - 3. Plumbing fixtures and equipment.
  - 4. Fire protection systems.
- C. Heating, Ventilating and Air Conditioning:
  - 1. Air handling equipment
  - 2. Air distribution systems
    - a. Supply, return and exhaust ductwork
    - b. Terminal outlets and accessories.
  - 3. Testing, adjusting and balancing HVAC systems.

**END OF SECTION**

**SECTION 230500  
BASIC MECHANICAL MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
  2. Transition fittings.
  3. Dielectric fittings.
  4. Sleeves.
  5. Escutcheons.
  6. Grout.
  7. Mechanical demolition.
  8. Equipment installation requirements common to equipment sections.
  9. Painting and finishing.
  10. Supports and anchorages.

**1.2 DEFINITIONS**

- A. The following are industry abbreviations for plastic and rubber materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
  2. CPVC: Chlorinated polyvinyl chloride plastic.
  3. PE: Polyethylene plastic.
  4. PVC: Polyvinyl chloride plastic.
  5. EPDM: Ethylene-propylene-diene terpolymer rubber.
  6. NBR: Acrylonitrile-butadiene rubber.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
1. Transition fittings.
  2. Dielectric fittings.
  3. Mechanical sleeve seals.
  4. Escutcheons.
  5. Pipe Curbs

**1.4 QUALITY ASSURANCE**

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

**1.5 DELIVERY, STORAGE, AND HANDLING**

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

**1.6 COORDINATION**

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

## **PART 2 - PRODUCTS**

### **2.1 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### **2.2 JOINING MATERIALS**

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

### **2.3 TRANSITION FITTINGS**

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
  - 2. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
  - 3. Aboveground Pressure Piping: Pipe fitting.
- B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

### **2.4 DIELECTRIC FITTINGS**

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F .

## **2.5 SLEEVES**

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## **2.6 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

## **2.7 GROUT**

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 MECHANICAL DEMOLITION**

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### **3.2 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Piping in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
  2. Existing Piping: Split-casting, type with above finish.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- P. Install grommet fitting in metal studs through which copper pipes pass.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.3 PIPING JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

### **3.4 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### **3.5 PAINTING**

- A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section "Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

**END OF SECTION**

**SECTION 230529  
HANGERS AND SUPPORTS**

**PART 1 - GENERAL**

**1.1 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. MFMA: Metal Framing Manufacturers Association.
- C. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.2 PERFORMANCE REQUIREMENTS**

- A. Design supports capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Pipe hangers and supports.
  - 2. Pipe positioning systems.
  - 3. Equipment supports.

**PART 2 - PRODUCTS**

**2.1 PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- B. Galvanized, Metallic Coatings: ASTM A525/526 pre-galvanized or ASTM A123 hot dipped.
- C. Nonmetallic Coatings: Plastic 5 mil thick coating.

**2.2 METAL MANUFACTURED MULTIPLE PIPE FRAMING SYSTEMS**

- A. Description: MFMA-4, shop-fabricated pipe-support assembly made of continuous slotted steel channels with in-turned lips and other components.
- B. Coatings: Hot-dipped galvanized steel.

**2.3 FASTENER SYSTEMS**

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.



- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## **2.4 METAL STUD GROMMET**

- A. Description: Non-metallic 360 deg. protection for positioning piping in metal studs.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36, steel plates, shapes, and bars; black and galvanized.

# **PART 3 - EXECUTION**

## **3.1 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment, except use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper.
- D. Horizontal Suspended Piping Hangers and Supports: Adjustable, Steel Clevis Hangers (MSS Type 1).
- E. Vertical-Piping Riser Clamps: Extension Pipe or Riser Clamps (MSS Type 8).
- F. Building Attachments: Install the following types:
  - 1. Steel Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  - 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 4. C-Clamps with locknut (MSS Type 23): For structural shapes.
- G. Insulation Protection Shields: (MSS type 40): Install of length recommended by manufacturer to prevent crushing insulation.
- H. Comply with MSS SP-69 for trapeze pipe hanger selections and applications.
- I. Comply with MFMA-102 for metal framing system selections and applications.
- J. Use powder-actuated fasteners or mechanical-expansion anchors where required in concrete construction.
- K. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### **3.2 HANGER AND SUPPORT INSTALLATION**

- A. Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Multiple Pipe Support Installation: Arrange for grouping of parallel runs of horizontal piping and support together on specified metal framing systems.
- C. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than **4 inches** thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
- D. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers and supports to allow controlled thermal movement of piping systems, to facilitate action of expansion loops, expansion bends, and similar units.
- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, and strainers, **NPS 2-1/2** and larger and at changes in direction of piping.
- H. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 are not exceeded.

### **3.3 PIPE SUPPORTS SPACING**

- A. Install hangers in accordance with latest edition of MSS-SP-69.

### **3.4 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches**.

### **3.6 PAINTING**

- A. Touch Up: Touchup with paint field welds, bolted connections, and abraded areas of metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**

**SECTION 230593  
TESTING, ADJUSTING, AND BALANCING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes TAB to produce design objectives for the following:
  - 1. Air Systems.
  - 2. Existing systems TAB.
  - 3. Verifying that automatic control devices are functioning properly.
  - 4. Reporting results of activities and procedures specified in this Section.

**1.2 SUBMITTALS**

- A. Certified TAB Reports: Submit four copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

**1.3 QUALITY ASSURANCE**

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."; SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" or TAB firm's forms approved by Engineer.
- C. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- D. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
  - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

**1.4 PROJECT CONDITIONS**

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

**1.5 COORDINATION**

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

## **PART 2 - PRODUCTS (Not Applicable)**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
  - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation. Report missing devices to Contractor, so corrections can be made without interrupting construction completion.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- D. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- E. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- F. Examine plenum ceilings used for return air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- G. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### **3.2 PREPARATION**

- A. Complete system readiness checks. Verify the following:
  - 1. Permanent electrical power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance and fire dampers are open.
  - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 6. Windows and doors can be closed so indicated conditions for system operations can be met.

### **3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING**

- A. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and

balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

- B. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- C. Take and report testing and balancing measurements in inch-pound (IP).

### **3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for all fans, inlets and outlets. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Verify that motor starters are equipped with properly sized thermal protection.
- C. Check dampers for proper position to achieve desired airflow path.
- D. Check for airflow blockages.
- E. Check condensate drains for proper connections and functioning.
- F. Check for proper sealing of air-handling unit components.
- G. Check for proper sealing of air duct system.

### **3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS**

- A. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
  - 1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
  - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
  - 3. Measure total system airflow. Adjust to within indicated airflow.
  - 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
  - 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
    - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

### **3.6 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS**

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused or replaced.
  1. Measure and record air outlet and air inlet airflows and compare to indicated air quantities. If differences from indicated cfm's are more than 10%, determine necessary action required to bring air flows to required quantities.
  2. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Report performance differences between existing equipment and specified replacement equipment and report results before new equipment is purchased.
- C. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
  1. New filters are installed.
  2. Coils are clean and fins combed.
  3. Drain pans are clean.
  4. Fans are clean.
  5. Bearings and other parts are properly lubricated.
  6. Strainers are clean.
- D. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
  1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
  2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
  3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
  4. Air balance each air outlet.

### **3.7 TOLERANCES**

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
  2. Air Outlets and Inlets: 0 to minus 10 percent.

### **3.8 REPORTING**

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

### **3.9 FINAL REPORT**

- A. General: Typewritten, or computer printout in letter-quality font, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 2. Nomenclature sheets for each item of equipment.
  - 3. Data for terminal units, including manufacturer, type size, and fittings.
  - 4. Notes to explain why certain final data in the body of reports varies from indicated values.

**END OF SECTION**

**SECTION 230700  
MECHANICAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets both factory and field applied.
  - 1. Include manufacturer's installation requirements for each type and application of insulation.

**1.2 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Indoor Air Quality Standards: Insulation and related materials shall have GREENGUARD Environmental Institute certification.

**1.3 COORDINATION**

- A. Coordinate size and location of supports, hangers and insulation shields.

**1.4 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

**PART 2 - PRODUCTS**

**2.1 INSULATION MATERIALS**

- A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Thermal conductivity (K-value) at 75 deg F is 0.27 BTU x in./h x sq. ft. x deg. F or less.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.: Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, Insul-Sheet and K-FLEX LS.
- B. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type III with factory-applied FSK jacket. Density is 0.75 lb/cu. ft. Thermal conductivity (K-value) at 75 deg F is 0.27 BTU x in./h x sq. ft. x deg. F or less.



1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; SoftTouch Duct Wrap.
- b. Johns Manville; Microlite.
- c. Knauf Insulation: Friendly Feel Duct Wrap.
- d. Owens Corning; SOFTR All-Service Duct Wrap.

C. Mineral-Fiber, Preformed Pipe Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ jacket. Thermal conductivity (K-value) at 75 deg F is 0.23 BTU x in./h x sq. ft. x deg. F or less.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Fibrex Insulations Inc.; Coreplus 1200.
- b. Johns Manville; Micro-Lok.
- c. Knauf Insulation; 1000-Degree Pipe Insulation.
- d. Owens Corning; Fiberglass Pipe Insulation.

## **2.2 INSULATING CEMENTS**

A. Comply with the following:

1. Mineral-Fiber – ASTM C196
2. Hydraulic-Setting Insulating and Finishing Cement – ASTM C449.

## **2.3 ADHESIVES, MASTICS & LAGGING**

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

1. Indoor adhesives for calcium silicate and mineral fiber insulation shall have a VOC content of 80 g/L or less when calculated according to CFR 59, Subpart D (EPA Method 24).
2. Indoor adhesives for flexible elastomeric and cellular glass insulation shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## **2.4 SEALANTS**

A. Joint Sealants: Materials shall be compatible with insulation materials, jackets, and substrates.

B. Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

C. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## **2.5 FIELD-APPLIED JACKETS**

- A. PVC Jacket: White, 30 mil, high-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
  - 1. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## **2.6 TAPES**

- A. FSK Tape: 3 inch wide, foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
- B. PVC Tape for Indoor Applications: 3 inch wide, white vapor-retarder PVDC tape with acrylic adhesive.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### **3.2 COMMON INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
  - 1. Installation shall conform to manufacturers recommendation, codes and industry standards.
- B. Keep insulation materials dry during application and finishing.
- C. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- D. Install insulation continuously through hangers and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
- E. Install insulation continuously through roof, wall and floor penetrations.
  - 1. Seal penetrations with flashing sealant.
- F. Insulation Installation on Fittings, Valves, Flanges, and Unions.
  - 1. Insulate using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular

surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

### **3.3 DUCT AND PLENUM INSULATION INSTALLATION**

- A. Secure with adhesive and insulation pins.
- B. Adjacent sections of wrap shall be tightly butted with 2 inch taping overlap.

### **3.4 FINISHES**

- A. Flexible Elastomeric Thermal Insulation: On outdoor applications, apply two coats of insulation manufacturer's recommended protective coating.

### **3.5 INDOOR DUCT INSULATION SCHEDULE**

- A. Ducts concealed above ceilings, duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2.2 inches thick.
- B. Duct drops to diffusers, supply fan flexible connections and top of diffusers insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2.2 inches thick.

### **3.6 PIPING INSULATION SCHEDULE, GENERAL**

- A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Fire-suppression piping.
  - 2. Drainage piping located in crawl spaces.
  - 3. Below-grade piping.
  - 4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### **3.7 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Cold Water:
  - 1. Insulation shall be any of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Mineral-Fiber: 1 inch thick.
- B. Domestic Hot Water:
  - 1. Insulation shall be any of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Mineral-Fiber: 1 inch thick.

**END OF SECTION**

**SECTION 233113  
METAL DUCTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible – Second Edition" for acceptable materials, material thicknesses, installation methods and duct construction methods, unless otherwise indicated. Fabrication shall be based on indicated static pressure for applicable sealing requirements.
- B. Comply with 2015 International Mechanical Code Section 603 for duct construction and installation requirements..

**1.3 SUBMITTALS**

- A. Product Data: For each type of the following products:
  - 1. Ductwork, Liners and adhesives.
  - 2. Sealants and gaskets.
  - 3. Factory fabricated duct and fittings.

**PART 2 - PRODUCTS**

**2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS**

- A. Transverse Joints: Select joint types and fabricate according to SMACNA's Figure 1-4, "Rectangular Duct/Transverse Joints."
  - 1. Prefabricated slide-on transverse connectors are accepted.
- B. Longitudinal Seams: Pittsburg lock seam according to SMACNA's Figure 1-5, L-1 "Rectangular Duct/Longitudinal Seams".
- C. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's Chapter 2, "Fittings and Other Construction".

**2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS**

- A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's, Figure 3-2, "Round Duct Transverse Joints, unless otherwise indicated.
  - 1. Joints in ducts larger than 50 inches in diameter: Flanged with synthetic rubber gasket.
  - 2. Joints in exposed spiral ducts smaller than 50 inches in diameter: Lindab Spiro Safe, Semco Velocity or equal.
    - a. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at -20" wg to +12 inch wg static pressure.
    - b. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's " Figure 3-1, "Round Duct Longitudinal Seams", unless otherwise indicated.
  - 1. Seams in ducts larger than 90 inches in diameter: butt-welded.
  - 2. Seams in flat-oval ducts larger than 72 inches in width (major dimension): butt-welded.
  - 3. Seams in exposed round ducts: spiral.
  - 4. Seams in concealed round ducts: Ductmate Green Seam sealed snap lock.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees". Saddle tap not allowed.

### **2.3 SHEET METAL MATERIALS**

- A. General Material Requirements: Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653 and A 924.
  - 1. Galvanized Coating Designation: G90.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36, steel plates, shapes, and bars; galvanized.
  - 1. Where galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### **2.4 SEALANT AND GASKETS**

- A. General Sealant and Gasket Requirements: Flexible, water based, surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 5 and a maximum smoke-developed index of 0 when tested according to UL 723; no VOC's; water based and mildew resistant.
  - 1. Manufacturer: Foster 32-17, United Duct Sealer or Ductmate Industries PROseal.
- B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

## **2.5 HANGERS AND SUPPORTS**

- A. Hanger Rods: Cadmium-plated steel rods and nuts.
  - 1. Aircraft cable hanging system, Ductmate Industries "Clutcher" may be used.
- B. Strap and Rod Sizes: Comply with SMACNA's Chapter 4.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Seal attachment points.
- D. Spacing between supports shall not exceed 8 feet.

## **PART 3 - EXECUTION**

### **3.1 DUCT INSTALLATION**

- A. 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.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and equipment access/service area.
- J. 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.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### **3.2 DUCT SEALING**

- A. Seal ducts to the following seal classes according to SMACNA:

1. Supply and return ducts: Seal Class A.
2. Indoor exhaust ducts: Seal Class C.
3. No "duct tape" allowed.

### **3.3 HANGER AND SUPPORT INSTALLATION**

- A. Comply with SMACNA's, 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.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. 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.
- E. Install upper attachments to structures. Select and size upper attachments with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.

### **3.4 CONNECTIONS**

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### **3.5 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Ducts equal to or less than 2-inch w.g. position or negative shall have no noticeable leakage detectable by noise, feel or sight.
- C. DUCT SCHEDULE
- C. Fabricate ducts with G90 galvanized sheet steel.
- D. Elbow Configuration:
  1. Rectangular Duct: Comply with SMACNA's, "Figure 2-2, "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, Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
  2. Round Duct: Comply with SMACNA's, "Figure 3-3, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's, "Table 3-1, "Mitered Elbows."
      - 1) Radius-to Diameter Ratio: 1.5.

- b. Round Elbows, 12 Inches and Smaller in Diameter: Segmented or Adjustable.
- c. Round Elbows, 14 Inches and Larger in Diameter: Segmented Standing seam.

E. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's," Figure 2-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Spin in with damper and insulation stand off as required.
- 2. Round: Comply with SMACNA's," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.

**END OF SECTION**



**SECTION 233300  
DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Turning vanes.
  - 3. Duct-mounted access doors.
  - 4. Flexible connectors.
  - 5. Flexible ducts.
  - 6. Duct accessory hardware.
  - 7. Stick on fitting.

**1.2 SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.1 MANUAL VOLUME DAMPERS**

- A. Standard, Steel, fabricate according to SMACNA Fig. 2-12, 2-13.
  - 1. Blades: Multiple (14 inch and higher) or single (12 inch and smaller) blade.
- B. Damper Hardware:
  - 1. Zinc-plated, dial and handle with hexagon locking nut.
  - 2. Include elevated platform for insulated duct mounting.

**2.2 TURNING VANES**

- A. General Requirements: Comply with SMACNA; Figures 2-3 and 2-4.
- B. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

**2.3 DUCT-MOUNTED ACCESS DOORS**

- A. Duct-Mounted Access Doors: Fabricate according to SMACNA's; Figures 2-10, and 2-11.
  - 1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as required.
    - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    - d. Fabricate doors airtight and suitable for duct pressure class.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

## **2.4 FLEXIBLE CONNECTORS**

- A. Materials: Flame-retardant or noncombustible fabrics, complying with UL 181, Class 1.
- B. Metal-Edged Connectors: Factory fabricated with a fabric strip 3 inches wide attached to 2 strips of 3-inch- wide, thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- C. Fabric: Woven nylon.
  - 1. Minimum Weight: 22 oz./sq. yd.
  - 2. Tensile Strength: 500 lbf/inch in the warp and 400 lbf/inch (63 N/mm) in the filling.
  - 3. Service Temperature: Minus 40 to plus 180 deg F.

## **2.5 FLEXIBLE DUCTS**

- A. Insulated, Flexible Duct: UL 181, Class 1, 2-ply nylon film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
  - 1. Pressure Rating: 6-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 250 deg F.
- B. Flexible Duct Connector:
  - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action.

## **2.6 DUCT ACCESSORY HARDWARE**

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

## **2.7 STICK ON FITTING**

- A. Galvanized 26 gauge construction with damper, and insulation build out.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.
- C. Install test holes at fan inlets and outlets as required.
- D. Label access doors according to indicate the purpose of access door.
- E. Install flexible connectors to connect ducts to equipment.

- F. Connect diffusers to low-pressure ducts with maximum 60-inch lengths of flexible duct clamped in place.
- G. Install duct test holes where required for testing and balancing purposes.

### **3.2 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
    - a. Drop test where required by local authorities.

**END OF SECTION**

**SECTION 233713  
DIFFUSERS, REGISTERS, AND GRILLES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes ceiling mounted diffusers, registers, and grilles.

**1.2 SUBMITTALS**

- A. Product Data: For each model indicated, include the following:
1. Data Sheet: For each type of unit, and accessory furnished; indicate construction, finish, and mounting details.
  2. Schedule of units indicating drawing designation, room location, quantity, model number, size, accessories furnished and performance data including throw and drop, static-pressure drop, and noise ratings.

**1.3 QUALITY ASSURANCE**

- A. Ceiling/Wall Compatibility: Coordinate mounting trim with ceiling system and wall type. Refer to Architectural Drawings.
- B. Finish: Units located in acoustical tile ceilings shall be white enamel; units located in painted surfaces shall be prime coat suitable for field painting.

**1.4 SOURCE QUALITY CONTROL**

- A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

**PART 2 - PRODUCTS**

**2.1 LINEAR CEILING THERMALLY POWERED DIFFUSERS (TD)**

- A. Thermally powered diffusers shall be Price/Acutherm Therma-Fuser Model TBDI6-HC as indicated. The model shall have a uniform face size and appearance when different neck sizes are used in the same area. The cone assembly shall have a variable discharge area at the perimeter for linear control, maximum Coanda effect and avoidance of dumping. Diffuser shall have 10 year warranty.
- B. Diffuser shall be thermally powered with adjustable setpoint and a heating/cooling changeover element. Diffuser shall have 2 slots, balancing damper, and boot with ½" liner.

**2.2 PERFORATED GRILLE (G)**

- A. Grilles shall be:
1. PRICE Model 10
  2. KRUEGER Model S80P.
  3. TITUS Model 8R.

- B. The face and border shall be constructed of perforated steel with 3/16" diameter holes on 1/4" staggered centers to provide 51% free area. Outer borders shall be 1/4" wide for surface mounted units and 1/4" wide for lay in units. Corners shall be assembled with full penetration resistance welds with a reinforcing patch for extra strength. Screw holes shall be countersunk.
- C. R: Shall have opposed blade damper.

### **2.3 PERFORATED PANEL (PP)**

- A. Perforated ceiling panels for return applications shall be:
  - 1. PRICE Model PFRF.
  - 2. KRUEGER Model 6790.
  - 3. TITUS Model PXP
- B. Perforated borderless face panel shall have 3/16" diameter holes on 1/4" staggered centers and no less than 51% free area.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install units level and plumb, according to manufacturer's written instructions, original design, and referenced standards.
- B. Install units with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- C. Ceiling-Mounted Units: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

### **3.2 ADJUSTING**

- A. After installation, adjust units to air patterns indicated, or as directed, before starting air balancing.

### **3.3 CLEANING**

- A. After installation of units, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace units that have damaged finishes.

**END OF SECTION**

**SECTION 233815  
AIR DUCT CLEANING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes cleaning of the existing water source heat pump duct systems shown to remain, and DOAS unit duct systems.

**1.2 DEFINITIONS**

- A. ASCS: Air system cleaning specialist.
- B. NADCA: National Air Duct Cleaners Association.
- C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

**1.3 SUBMITTALS**

- A. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.
- B. Qualification Data: For ASCS.
- C. Field quality-control test reports.

**1.4 QUALITY ASSURANCE**

- A. ASCS Qualifications: A certified member of NADCA.
  - 1. Certification: Employ an ASCS certified by NADCA on a full-time basis.
  - 2. Supervisor Qualifications: Certified as an ASCS by NADCA.
  - 3. Experience: Submit records of experience in the field of commercial HVAC systems cleaning minimum 5 years.
  - 4. Equipment, Materials, and Labor: Have equipment, materials, and labor required to perform specified services.
- B. Comply with current published standards of NADCA.

**PART 2 - PRODUCTS**

**2.1 SHEET METAL MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

**2.2 DUCT-MOUNTING ACCESS DOORS**

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.

- B. Rectangular Duct Door: Double wall; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include 1-by-1-inch butt or piano hinge and cam latches.
  - 1. Frame: Galvanized-steel sheet; with bendover tabs and foam gaskets.
  - 2. Provide number of hinges and locks as follows:
    - a. Less Than 12 Inches Square: Secure with two sash locks.
    - b. Up to 18 Inches Square: Two hinges and two sash locks.
    - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
- C. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- D. Insulation: 1-inch-thick fibrous-glass board.

### **2.3 DUCT ACCESSORY HARDWARE**

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.
- B. Flexible-Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine systems to determine appropriate methods, tools, and equipment required for performance of work.
- B. Prepare written report listing conditions detrimental to performance of work and outlining proposed method/sequence of cleaning.
- C. Proceed with work only after unsatisfactory conditions have been corrected.
- D. Coordinate shut down of air handling equipment with Owner.

### **3.2 CLEANING**

- A. Engage a qualified ASCS to clean existing ducts to remain.
- B. Perform cleaning before air balancing or mark position of dampers and air-directional mechanical devices before cleaning.
- C. Provide duct-mounted access doors, as required, for physical and mechanical entry and for inspection.
  - 1. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  - 2. Remove and reinstall ceiling components to gain access for duct cleaning. Clean ceiling components after they have been removed and replaced.
  - 3. Disconnect and reconnect flexible connectors as needed for cleaning and inspection.

- D. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.
- E. Particulate Collection and Odor Control:
  - 1. Where venting vacuuming system inside building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or greater) particles.
  - 2. When venting vacuuming system outside building, use filtration to contain debris removed from the HVAC system and locate exhaust down wind and away from air intakes and other points of entry into building.
  - 3. Provide cheesecloth on air diffusers to collect particles dislodged during cleaning.
- F. Clean the following metal-duct system components by removing visible surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Return-air ducts, dampers, and turning vanes.
  - 3. Supply-air ducts, dampers, and turning vanes.
- G. 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 ducts 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 or duct liner.
  - 4. 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.
  - 5. Provide operative drainage system for washdown procedures.
  - 6. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present; use according to manufacturer's written instructions and EPA registration listing after removal of surface deposits and debris.
- H. Cleanliness Verification:
  - 1. Verify cleanliness after mechanical cleaning in presence of Owner and before application of treatment, including biocidal agents and protective coatings.
  - 2. Visually inspect metal-duct systems for contaminants.
  - 3. Where contaminants are discovered, reclean and reinspect duct systems.



### **3.3 DUCT ACCESSORIES INSTALLATION**

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- B. Install duct-mounting access doors where access doors do not currently exist to allow for the cleaning of ducts, accessories, and terminal units as follows:
  - 1. On both sides of duct coils.
  - 2. Downstream from volume dampers, turning vanes, and equipment.
  - 3. Adjacent to fire or smoke dampers; reset or install new fusible links.
  - 4. Before and after each change in direction, at maximum 50-foot spacing.
  - 5. On sides of ducts where adequate clearance is available.
- C. Install the following sizes for duct-mounting, rectangular access doors:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
- D. Install the following sizes for duct-mounting, round access doors:
  - 1. One-Hand or Inspection Access: 8 inches in diameter.
  - 2. Two-Hand Access: 10 inches in diameter.
  - 3. Head and Hand Access: 12 inches in diameter.

### **3.4 CONNECTIONS**

- A. Reconnect diffusers to low-pressure ducts with existing flexible ducts.
- B. Reconnect existing flexible ducts to metal ducts with draw bands.

### **3.5 FIELD QUALITY CONTROL**

- A. Gravimetric Analysis: Sections of metal-duct system, chosen randomly by Owner, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.
  - 1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
  - 2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal-duct system shall be recleaned and reverified.
- B. Report results of tests in writing.
- C. Provide photographic documentation of before and after conditions for a minimum of 3 locations in each air handling system.

**END OF SECTION 233815**

**SECTION 260400  
BASIC ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this and all other sections of Division 26.

**1.2 WORK INCLUDED:**

- A. All labor, materials, appliances, equipment, tools, transportation, superintendence, and services necessary for and reasonably incidental to execution of a complete electrical system for the building areas shall be provided as herein specified and as indicated. All minor equipment, specialties and appurtenances required to complete the systems and necessary to their proper operation, shall be provided.

**1.3 QUALITY ASSURANCE:**

- A. Codes and Standards:
  - 1. Virginia Statewide Building Code Compliance: Comply with applicable requirements of Virginia Statewide Building Code.
  - 2. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publications pertaining to raceways.
  - 3. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards.
  - 4. NEC Compliance: Comply with applicable requirements of National Electric Code.

**1.4 INTENT:**

- A. Where any specific materials, process, or method of construction, or manufactured article is specified by name or by reference to the catalogue number of a manufacturer, the specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance. Contractor shall verify the duty and performance with the specific characteristics of the equipment offered for installation.
  - 1. Conflicts between model numbers and performance requirements shall be resolved before submitting shop drawings. Failure to do so may result in Contractor having to remove and replace, at his expense, this work.

**1.5 REQUIREMENTS FOR BIDDERS:**

- A. Contractor shall examine the drawings relating specifically to this work and assume responsibility for the proper fitting of the material and equipment in the building as indicated with the existing clearances; examine the drawings and specifications relating to the work of all trades; become fully informed as to the extent and character of all other work; visit the site; make arrangements to avoid conflicts and interference with other features of construction and

fully coordinate all components of this system so that they can be installed in proper relationship to other work and to the best interest of Owner.

1. The Drawings are to be considered diagrammatic, not necessarily showing in detail or scale all minor items. Unless specific dimensions are shown, the structural, architectural and site conditions shall govern the exact locations. Contractor shall follow drawings in laying out work, check drawings of trades to verify spaces in which work will be installed and maintain maximum head room, and space conditions at all points. Where head room, or space conditions appear inadequate, Engineer shall be notified before proceeding with installation. This Contractor shall, without extra charge, make field modification in layout as needed to prevent conflict with work of various trades or proper execution of the work.
2. Examine all drawings carefully prior to submitting a bid. Contractor will be required to furnish, install and or connect with appropriate services all electrical items shown on electrical drawings without additional expenses to the Owner. If discrepancies, conflicts, interferences or omissions occur between drawings, notify in writing the Engineer in ample time to permit revisions before the bids are submitted.

#### **1.6 PRODUCT SUBSTITUTIONS:**

- A. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings boxes, wire, conduit, fasteners, and similar items used in work, except as otherwise indicated.
- B. Provide products which are compatible within systems and other connected items.
- C. Where Contractor proposes to use any item of equipment other than that indicated which requires any redesign of the structure, partitions, foundations, raceways, wiring, or of any other part of the electrical, mechanical or architectural layout, all such redesign, and all new drawings and detailing required therefore, shall, be approved by Engineer, and shall be prepared by Contractor at his own expense.
- D. Where such approved deviation requires a different quantity and/or arrangement of wiring, conduit and equipment from that specified or indicated, Contractor shall provide same at no additional cost to Owner subject to approval by Engineer. Contractor requesting the change shall notify all trades involved and receive from the affected contractors a statement approving the deviation; failure to secure this approval shall subject Contractor requesting the deviations to all back charges rendered by the other affected Contractors.

#### **1.7 RULES, PERMITS AND FEES**

- A. Contractor shall give all necessary notices, pay all connection fees; obtain and pay for all permits; file all necessary drawings; prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required Certificates of Inspection for his work and deliver same to Engineer before request for acceptance and final payment for the work.

#### **1.8 MATERIAL AND WORKMANSHIP**

- A. Unless specified otherwise hereinafter, all materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished

in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind of quality of material is given, a first-class standard article as approved by Engineer shall be furnished. All work shall be performed in a neat and workmanlike manner by mechanics specially trained in the trade involved.

- B. Unless otherwise specifically indicated on the drawings, or in the specifications, all equipment and materials shall be applied subject to approval of Engineer, in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

## **1.9 UTILITY SERVICES**

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
  - 1. Provide at least seven days notice to Owner if shutdown of service is required during changeover.

## **1.10 MAINTENANCE MANUALS**

- A. Prepare maintenance manuals to include the following information for equipment items:
  - 1. Copy of specification section and reviewed shop drawing relating to each equipment item.
  - 2. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  - 3. Manufacturer's printed installation instructions and application data.
  - 4. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
  - 5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassemble; aligning and adjusting instructions.
  - 6. Servicing instructions and schedules.

## **1.11 CUTTING AND PATCHING**

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

## **PART 2 - PRODUCTS**

NOT APPLICABLE

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of site improvements, utilities, mechanical systems, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
1. Before construction, verify the location and points of connection of utility services.
  2. Start of work by Contractor shall be considered as acceptance by him of all claims or questions as to suitability of the work of other trades or other Contractors to receive his work. This Contractor shall remove and replace, at his expense, all electrical work which may have to be removed because of interference with other trades.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Prepare a written report listing conditions detrimental to performance of the Work, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes.
  3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  5. Examine ceiling plenum clearances for suitable space to install mechanical and electrical systems as indicated.
  6. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

#### **3.2 PREPARATION**

- A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than seven days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### **3.3 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### **3.4 CORRECTION OF THE WORK**

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

### **3.5 ROUGH-IN**

- A. Verify final locations and sizes for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

**END OF SECTION**

## SECTION 260519

### LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Copper building wire rated 600 V or less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
  - 1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

##### 1.3 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

##### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### PART 2 - PRODUCTS

##### 2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alpha Wire Company.
  - 2. American Bare Conductor.
  - 3. Belden Inc.
  - 4. Cerro Wire LLC.
  - 5. Encore Wire Corporation.
  - 6. General Cable Technologies Corporation.

7. Okonite Company (The).
8. Service Wire Co.
9. Southwire Company.
10. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. Type RHH and Type RHW-2: Comply with UL 44.
3. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
4. Type THHN and Type THWN-2: Comply with UL 83.
5. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
6. Type UF: Comply with UL 83 and UL 493.
7. Type XHHW-2: Comply with UL 44.

## 2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

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

1. 3M Electrical Products.
2. AFC Cable Systems; a part of Atkore International.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; a brand of Emerson Industrial Automation.
9. Service Wire Co.
10. TE Connectivity Ltd.
11. Thomas & Betts Corporation; A Member of the ABB Group.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with long barrels.
3. Termination: Compression.



## **PART 3 - EXECUTION**

### **3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

### **3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- E. Final connections to lights, HVAC equipment, and similar locations: Single conductors in flexible conduit limited to the last 72" maximum.

### **3.3 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

### **3.4 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for copper and aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### **3.5 IDENTIFICATION**

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### **3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### **3.7 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."
- B. For penetrations thru non fire-rated assemblies, pack opening with approved fire safing mineral wool insulation and seal both sides of the penetration with approved intumescent fire caulk.

### **3.8 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements:
  - 2. Perform each of the following visual and electrical tests:
    - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    - b. Test bolted connections for high resistance using one of the following:
      - 1) A low-resistance ohmmeter.
      - 2) Calibrated torque wrench.
      - 3) Thermographic survey.
    - c. Inspect compression-applied connectors for correct cable match and indentation.
    - d. Inspect for correct identification.
    - e. Inspect cable jacket and condition.
    - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    - g. Continuity test on each conductor and cable.
    - h. Uniform resistance of parallel conductors.

- B. Cables shall be considered defective if they do not pass tests and inspections and shall be replaced.

**END OF SECTION**

## SECTION 260523

### CONTROL-VOLTAGE ELECTRICAL POWER CABLES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Category 5e balanced twisted pair cable.
  - 2. Category 6 balanced twisted pair cable.
  - 3. Category 6a balanced twisted pair cable.
  - 4. Balanced twisted pair cabling hardware.
  - 5. RS-485 cabling.
  - 6. Low-voltage control cabling.
  - 7. Control-circuit conductors.
  - 8. Identification products.

##### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
- D. RCDD: Registered Communications Distribution Designer.

##### 1.4 ACTION SUBMITTALS

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

##### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency, RCDD, layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
  - 1. Flame Travel Distance: 60 inches or less.
  - 2. Peak Optical Smoke Density: 0.5 or less.
  - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- E. RoHS compliant.

### **2.2 CATEGORY 5e BALANCED TWISTED PAIR CABLE**

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
  - 2. Belden Inc.
  - 3. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 4. CommScope, Inc.
  - 5. General Cable; General Cable Corporation.
  - 6. Hitachi Cable America Inc.
  - 7. Mohawk; a division of Belden Networking, Inc.
  - 8. SYSTIMAX Solutions; a CommScope Inc. brand.
  - 9. West Penn Wire.
- C. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.
- D. Conductors: 100-ohm, 24 AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP)
- F. Cable Rating: Plenum.
- G. Jacket: Blue thermoplastic.

## 2.3 CATEGORY 6 BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. 3M.
  - 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
  - 3. Belden CDT Networking Division/NORDX.
  - 4. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 5. CommScope, Inc.
  - 6. Draka USA.
  - 7. General Cable; General Cable Corporation.
  - 8. Genesis Cable Products; Honeywell International, Inc.
  - 9. Hitachi Cable America Inc.
  - 10. Mohawk; a division of Belden Networking, Inc.
  - 11. Superior Essex Inc.
  - 12. SYSTIMAX Solutions; a CommScope Inc. brand.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP).
- F. Cable Rating: Plenum.
- G. Jacket: Blue or Yellow thermoplastic.

## 2.4 CATEGORY 6a BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. 3M.
  - 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
  - 3. Belden CDT Networking Division/NORDX.
  - 4. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 5. CommScope, Inc.
  - 6. Draka USA.
  - 7. General Cable; General Cable Corporation.
  - 8. Genesis Cable Products; Honeywell International, Inc.
  - 9. Hitachi Cable America Inc.
  - 10. Mohawk; a division of Belden Networking, Inc.
  - 11. Superior Essex Inc.
  - 12. SYSTIMAX Solutions; a CommScope Inc. brand.
- C. Standard: Comply with TIA-568-C.2 for Category 6a cables.

- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP).
- F. Cable Rating: Plenum.
- G. Jacket: Blue or Yellow thermoplastic.

## 2.5 **BALANCED TWISTED PAIR CABLE HARDWARE**

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. 3M.
  - 2. American Technology Systems Industries, Inc.
  - 3. AMP NETCONNECT; a TE Connectivity Ltd. company.
  - 4. Belden CDT Networking Division/NORDX.
  - 5. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 6. CommScope, Inc.
  - 7. Draka USA.
  - 8. Dynacom Corporation.
  - 9. General Cable; General Cable Corporation.
  - 10. Genesis Cable Products; Honeywell International, Inc.
  - 11. Hitachi Cable America Inc.
  - 12. Hubbell Premise Wiring.
  - 13. KRONE Incorporated.
  - 14. Leviton Manufacturing Co., Inc.
  - 15. Mohawk; a division of Belden Networking, Inc.
  - 16. Molex Premise Networks.
  - 17. Panduit Corp.
  - 18. Siemon Co. (The).
  - 19. Superior Essex Inc.
  - 20. SYSTIMAX Solutions; a CommScope Inc. brand.
- C. General Requirements for Balanced Twisted Pair Cable Hardware:
  - 1. Comply with the performance requirements of Category 5e, Category 6 and Category 6a.
  - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  - 3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain balanced twisted pair cable hardware from single source from single manufacturer.
- E. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with an eight-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
  - 2. Patch cords shall have color-coded boots for circuit identification.

F. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
3. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standards:
  - a. Category 5e, unshielded balanced twisted pair cable shall comply with IEC 60603-7-2.
  - b. Category 5e, shielded balanced twisted pair cable shall comply with IEC 60603-7-3.
  - c. Category 6, unshielded balanced twisted pair cable shall comply with IEC 60603-7-4.
  - d. Category 6, shielded balanced twisted pair cable shall comply with IEC 60603-7.5.
  - e. Category 6a, unshielded balanced twisted pair cable shall comply with IEC 60603-7-41.
  - f. Category 6a, shielded balanced twisted pair cable shall comply with IEC 60603-7.51.
4. Marked to indicate transmission performance.

H. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

**2.6 LOW-VOLTAGE CONTROL CABLE**

A. Paired Cable: NFPA 70, Type CMG.

1. Multi-pair, twisted, No. 16 AWG, stranded 19x29.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Multi-pair, twisted, No. 16 AWG, stranded 19x29.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.



## 2.7 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Encore Wire Corporation.
  - 2. General Cable; General Cable Corporation.
  - 3. Service Wire Co.
  - 4. Southwire Company.
- B. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Test cables on receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

### 3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
  - 1. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA-568-C Series of standards.
  - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
  - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
  - 4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.

5. Cables serving a common system may be grouped in a common raceway. Install control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

### 3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

### 3.5 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

### 3.6 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

### **3.7 GROUNDING**

- A. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

### **3.8 IDENTIFICATION**

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

### **3.9 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections and shall be replaced.

**END OF SECTION**

## SECTION 260526

### GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

##### 1.3 ACTION SUBMITTALS

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

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article.
- B. Field quality-control reports.

##### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Instructions for periodic testing and inspection of grounding features based on NFPA 70B.
      - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
      - 2) Include recommended testing intervals.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### **2.2 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. ABB (Electrification Products Division).
  - 2. Advanced Lightning Technology, Ltd.
  - 3. Dossert; AFL Telecommunications LLC.
  - 4. Emerson Electric Co. (Automation Solutions - Appleton - O-Z/Gedney).
  - 5. Fushi Copperweld Inc.
  - 6. Galvan Industries, Inc.; Electrical Products Division, LLC.
  - 7. Harger Lightning & Grounding.
  - 8. Hubbell Incorporated (Burndy).
  - 9. ILSCO.
  - 10. nVent (ERICO).
  - 11. Robbins Lightning, Inc.
  - 12. Siemens Industry, Inc., Energy Management Division.

### **2.3 CONDUCTORS**

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B3.
  - 2. Stranded Conductors: ASTM B8.
  - 3. Tinned Conductors: ASTM B33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

### **2.4 CONNECTORS**

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- D. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- E. Conduit Hubs: Mechanical type, terminal with threaded hub.
- F. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- G. Straps: Solid copper, copper lugs. Rated for 600 A.
- H. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one or two-piece clamp.
- I. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

## **PART 3 - EXECUTION**

### **3.1 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Connections to Structural Steel: Welded connectors.

### **3.2 EQUIPMENT GROUNDING**

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.

### **3.3 INSTALLATION**

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
  
- C. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
  
- D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
  
- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
  
- F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding system at each location where a maximum ground-resistance level is specified.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 5 ohms.
  2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

**END OF SECTION**



## SECTION 260529

### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Steel slotted support systems.
  - 2. Aluminum slotted support systems.
  - 3. Conduit and cable support devices.
  - 4. Support for conductors in vertical conduit.
  - 5. Structural steel for fabricated supports and restraints.
  - 6. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
  - 7. Fabricated metal equipment support assemblies.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Slotted support systems, hardware, and accessories.
    - b. Clamps.
    - c. Hangers.
    - d. Sockets.
    - e. Eye nuts.
    - f. Fasteners.
    - g. Anchors.
    - h. Saddles.
    - i. Brackets.
  - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
  - 1. Hangers. Include product data for components.
  - 2. Slotted support systems.
  - 3. Equipment supports.
  - 4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M.
  2. AWS D1.2/D1.2M.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame Rating: Class 1.
  2. Self-extinguishing according to ASTM D 635.

#### 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches on center in at least one surface.
  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. Allied Tube & Conduit; a part of Atkore International.
    - b. B-line, an Eaton business.
    - c. ERICO International Corporation.
    - d. Flex-Strut Inc.
    - e. Gripple Inc.
    - f. Thomas & Betts Corporation; A Member of the ABB Group.
    - g. Unistrut; Part of Atkore International.
    - h. Wesanco, Inc.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Material for Channel, Fittings, and Accessories: Galvanized steel or Stainless steel, Type 304 or Stainless steel, Type 316.
  4. Channel Width: Selected for applicable load criteria.
  5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches on center in at least one surface.

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. Cooper Industries, Inc.
    - b. Flex-Strut Inc.
    - c. Haydon Corporation.
    - d. MKT Metal Manufacturing.
    - e. Thomas & Betts Corporation; A Member of the ABB Group.
    - f. Unistrut; Part of Atkore International.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Channel Material: 6063-T5 aluminum alloy.
  4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
  5. Channel Width: Selected for applicable load criteria.
  6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Conduit and Cable Support Devices: Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: Stainless-steel springhead type.
  7. Hanger Rods: Threaded steel.

### **2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES**

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA 101
  - 3. NECA 102.
  - 4. NECA 105.
  - 5. NECA 111.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

### **3.2 SUPPORT INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  7. To Light Steel: Sheet metal screws.
  8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### **3.3 INSTALLATION OF FABRICATED METAL SUPPORTS**

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### **3.4 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 099113 "Exterior Painting", Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**

## SECTION 260533

### RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Metal wireways and auxiliary gutters.
  - 3. Surface raceways.
  - 4. Boxes, enclosures, and cabinets.
- B. Related Requirements:
  - 1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.

##### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

##### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  - 1. Structural members in paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

#### A. Metal Conduit:

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. AFC Cable Systems; a part of Atkore International.
  - b. Allied Tube & Conduit; a part of Atkore International.
  - c. Anamet Electrical, Inc.
  - d. Calconduit.
  - e. Electri-Flex Company.
  - f. NEC, Inc.
  - g. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - h. Patriot Aluminum Products, LLC.
  - i. Perma-Cote.
  - j. Picoma Industries, Inc.
  - k. Southwire Company.
  - l. Thomas & Betts Corporation; A Member of the ABB Group.
  - m. Western Tube and Conduit Corporation.
  - n. Wheatland Tube Company.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. ARC: Comply with ANSI C80.5 and UL 6A.
5. IMC: Comply with ANSI C80.6 and UL 1242.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

#### B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. AFC Cable Systems; a part of Atkore International.
  - b. Allied Tube & Conduit; a part of Atkore International.
  - c. Anamet Electrical, Inc.
  - d. Calconduit.
  - e. Electri-Flex Company.
  - f. FSR Inc.
  - g. Korkap.
  - h. NEC, Inc.
  - i. Opti-Com Manufacturing Network, Inc (OMNI).
  - j. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - k. Patriot Aluminum Products, LLC.
  - l. Perma-Cote.
  - m. Republic Conduit.
  - n. Southwire Company.
  - o. Thomas & Betts Corporation; A Member of the ABB Group.
  - p. Topaz Electric; a division of Topaz Lighting Corp.

- q. Western Tube and Conduit Corporation.
  - r. Wheatland Tube Company.
2. Comply with NEMA FB 1 and UL 514B.
  3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  4. Fittings, General: Listed and labeled for type of conduit, location, and use.
  5. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Compression.
  6. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. B-line, an Eaton business.
  2. Hoffman; a brand of Pentair Equipment Protection.
  3. MonoSystems, Inc.
  4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Flanged-and-gasketed type, unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.3 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.



1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Hubbell Incorporated; Wiring Device-Kellems.
  - b. MonoSystems, Inc.
  - c. Panduit Corp.
  - d. Wiremold / Legrand.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Adalet.
  2. Crouse-Hinds, an Eaton business.
  3. EGS/Appleton Electric.
  4. Erickson Electrical Equipment Company.
  5. FSR Inc.
  6. Hoffman; a brand of Pentair Equipment Protection.
  7. Hubbell Incorporated.
  8. Hubbell Incorporated; Wiring Device-Kellems.
  9. Kraloy.
  10. Milbank Manufacturing Co.
  11. MonoSystems, Inc.
  12. O-Z/Gedney; a brand of Emerson Industrial Automation.
  13. RACO; Hubbell.
  14. Spring City Electrical Manufacturing Company.
  15. Thomas & Betts Corporation; A Member of the ABB Group.
  16. Topaz Electric; a division of Topaz Lighting Corp.
  17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, [cast aluminum] [galvanized, cast iron] with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep, as needed.

- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
  - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
  - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### **PART 3 - EXECUTION**

#### **3.1 RACEWAY APPLICATION**

- A. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed and Subject to Severe Physical Damage.
  - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 4. Final connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 5. Damp or Wet Locations: IMC.
  - 6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. EMT: Use Compression, steel fittings. Comply with NEMA FB 2.10.
  - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.

### 3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not fasten conduits onto the bottom side of a metal deck roof.
- D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Complete raceway installation before starting conductor installation.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Stub-Ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- T. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Conduit extending from interior to exterior of building.
  2. Where otherwise required by NFPA 70.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- X. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- CC. Locate boxes so that cover or plate will not span different building finishes.
- DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

### **3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### **3.4 FIRESTOPPING**

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

### **3.5 PROTECTION**

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

**END OF SECTION**

## SECTION 260553

### IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
  - 2. Labels.
  - 3. Bands and tubes.
  - 4. Tapes and stencils.
  - 5. Tags.
  - 6. Signs.
  - 7. Cable ties.
  - 8. Paint for identification.
  - 9. Fasteners for labels and signs.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For arc-flash hazard study.

#### PART 2 - PRODUCTS

##### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.

- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## **2.2 COLOR AND LEGEND REQUIREMENTS**

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
  - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 4. Color for Neutral: White.
  - 5. Color for Equipment Grounds: Green.
- C. Warning Label Colors:
  - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
- E. Equipment Identification Labels:
  - 1. Black letters on a white field.

## **2.3 LABELS**

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
  - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  - 2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors.
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## **2.4 BANDS AND TUBES**

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

## **2.5 TAPES AND STENCILS**

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## **2.6 TAGS**

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.



- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
- C. Write-on Tags:
  - 1. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
  - 2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

## 2.7 SIGNS

- A. Baked-Enamel Signs:
  - 1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal Size: 7 by 10 inches.
- B. Metal-Backed Butyrate Signs:
  - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal Size: 10 by 14 inches.
- C. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    - b. For signs larger than 20 sq. in., 1/8 inch thick.
    - c. Engraved legend with white letters on a dark gray background.
    - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
    - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.8 CABLE TIES

- A. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F.
  - 5. Color: Black.

## 2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

#### **3.2 INSTALLATION**

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "POWER."
- L. Vinyl Wraparound Labels:
  - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Labels:
1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
- P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- V. Metal Tags:
1. Place in a location with high visibility and accessibility.
  2. Secure using plenum-rated cable ties.
- W. Nonmetallic Preprinted Tags:
1. Place in a location with high visibility and accessibility.
  2. Secure using plenum-rated cable ties.
- X. Write-on Tags:
1. Place in a location with high visibility and accessibility.
  2. Secure using plenum-rated cable ties.
- Y. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

Z. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

AA. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

BB. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

### 3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive raceway labels.
  1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
  1. "EMERGENCY POWER"
  2. "POWER"
  3. "LIGHTING"
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
  1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
  - 1. Apply to exterior of door, cover, or other access.
  - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- M. Arc Flash Warning Labeling: Self-adhesive labels.
- N. Operating Instruction Signs: Self-adhesive labels.
- O. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- P. Equipment Identification Labels:
  - 1. Indoor Equipment: Baked-enamel signs.
  - 2. Equipment to Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label and shall include panel name, panel size (amps), voltage rating, source of power and location (space name/number).
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

- e. Emergency system boxes and enclosures.
- f. Push-button stations.
- g. Power-transfer equipment– label shall include name, size (amps), voltage rating, source of power and location (space name/number).
- h. Contactors.
- i. Remote-controlled switches, dimmer modules, and control devices.
- j. Battery-inverter units.

**END OF SECTION**

## SECTION 260923

### LIGHTING CONTROL DEVICES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Indoor occupancy sensors.
  - 2. Switchbox-mounted occupancy sensors.
  - 3. Emergency shunt relay.
  - 4. Conductors and cables.
- B. Related Requirements:
  - 1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Show installation details for the following:
    - a. Occupancy sensors.
    - b. Vacancy sensors.
  - 2. Interconnection diagrams showing field-installed wiring.
  - 3. Include diagrams for power, signal, and control wiring.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which equipment will be attached.
  - 3. Items penetrating finished ceiling, including the following:

- a. Luminaires.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
  - f. Control modules.
- B. Field quality-control reports.
  - C. Sample Warranty: For manufacturer's warranties.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.
- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of lighting control software.
    - b. Faulty operation of lighting control devices.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Bryant Electric.
  - 2. Cooper Industries, Inc.
  - 3. Douglas Lighting Controls.
  - 4. Hubbell Building Automation, Inc.
  - 5. Intermatic, Inc.
  - 6. Leviton Manufacturing Co., Inc.



7. Lithonia Lighting; Acuity Brands Lighting, Inc.
8. Lutron Electronics Co., Inc.
9. NSi Industries LLC.
10. RAB Lighting.
11. Sensor Switch, Inc.
12. Signify North America Corporation (formerly Philips Lighting).
13. Square D.
14. WattStopper; a Legrand® Group brand.

B. General Requirements for Sensors:

1. Wall/Ceiling-mounted, solid-state indoor occupancy sensors.
2. Dual technology.
3. Separate power pack.
4. Hardwired connection to switch.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:
  - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
7. Sensor Output: Sensor is powered from the power pack.
8. Power: Low voltage.
9. Power Pack: Dry contacts rated for 20A LED load at 120- and 277-V ac and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:
  - a. Sensor: Suitable for mounting in any position on a standard outlet box.
  - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
  - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.

## 2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Bryant Electric.
  2. Cooper Industries, Inc.
  3. Douglas Lighting Controls.
  4. Hubbell Building Automation, Inc.
  5. Intermatic, Inc.
  6. Leviton Manufacturing Co., Inc.
  7. Lithonia Lighting; Acuity Brands Lighting, Inc.
  8. Lutron Electronics Co., Inc.
  9. NSi Industries LLC.
  10. RAB Lighting.
  11. Sensor Switch, Inc.
  12. Signify North America Corporation (formerly Philips Lighting).
  13. Square D.
  14. WattStopper; a Legrand® Group brand.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox/
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
  4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V.
- C. Wall-Switch Sensor #1:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
  2. Sensing Technology: Dual technology - PIR and ultrasonic.
  3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
  4. Capable of controlling load in three-way application.
  5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
  6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
  7. Color: White.
  8. Faceplate: Color matched to switch.

## 2.3 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Lighting Control and Design.
  2. WattStopper; a Legrand® Group brand.

- B. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

- 1. Coil Rating: 277 V.

## **2.4 CONDUCTORS AND CABLES**

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION OF SENSORS**

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### **3.3 INSTALLATION OF WIRING**

- A. Comply with NECA 1.

- B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.
- D. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### **3.4 IDENTIFICATION**

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

### **3.5 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.6 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
  - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
  - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

### **3.7 SOFTWARE SERVICE AGREEMENT**

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

### **3.8 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

**END OF SECTION**

## **SECTION 262416**

### **PANELBOARDS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

##### **1.3 DEFINITIONS**

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
  - 4. Detail bus configuration, current, and voltage ratings.
  - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 6. Include evidence of NRTL listing for series rating of installed devices.
  - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 8. Include wiring diagrams for power, signal, and control wiring.
  - 9. Key interlock scheme drawing and sequence of operations.

10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

### **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Keys: Two spares for each type of panelboard cabinet lock. All panelboards shall be keyed alike.

### **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to [NECA 407] [NEMA PB 1].

### **1.9 FIELD CONDITIONS**

- A. Environmental Limitations:
  1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  1. Ambient temperatures within limits specified.
  2. Altitude not exceeding 6600 feet.

- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Owner's written permission.
  - 3. Comply with NFPA 70E.

## **1.10 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
  - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PANELBOARDS REQUIREMENTS**

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Surface-mounted, dead-front cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, [Type 1].
  - 2. Height: 84 inches maximum.
  - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
  - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
  - 5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  - 6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  - 7. Finishes:
    - a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.



- c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- F. Incoming Mains:
  - 1. Location: Top.
  - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- G. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Dual rated.
  - 2. Terminations shall allow use of 75 deg C rated conductors without derating.
  - 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  - 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  - 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- J. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
  - 1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
  - 2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.2 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

PANELBOARDS

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Henrico County Human Serv. & Social Serv. Lobby Reno  
8600 Dixon Powers Drive, Henrico, Virginia 23228

June 14, 2024

1. Eaton.
2. ESL Power Systems, Inc.
3. General Electric Company; GE Energy Management - Electrical Distribution.
4. Mersen USA.
5. SIEMENS Industry, Inc.; Energy Management Division.
6. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

### **2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

### **2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES**

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. SIEMENS Industry, Inc.; Energy Management Division.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:
  - a. Inverse time-current element for low-level overloads.
  - b. Instantaneous magnetic trip element for short circuits.
  - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
4. MCCB Features and Accessories:
  - a. Standard frame sizes, trip ratings, and number of poles.
  - b. Breaker handle indicates tripped status.
  - c. UL listed for reverse connection without restrictive line or load ratings.
  - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
  - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage [without intentional] [with field-adjustable 0.1- to 0.6-second] time delay.
  - h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
  - i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
  - j. Multipole units enclosed in a factory assembly to operate as a single unit.
  - k. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
  - l. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## **2.5 IDENTIFICATION**

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## **2.6 ACCESSORY COMPONENTS AND FEATURES**

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407, NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407, NEMA PB 1.1.
- D. Equipment Mounting:
  - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- I. Mount surface-mounted panelboards to steel slotted supports 1 1/4 inch in depth. Orient steel slotted supports vertically.
- J. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

- K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- L. Install filler plates in unused spaces.
- M. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- N. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- O. Mount spare fuse cabinet in accessible location.

### **3.3 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

### **3.4 FIELD QUALITY CONTROL**

- A. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Instruments and Equipment:

- 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections. Replace panelboards or parts thereof, if found defective.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Submit to engineer.

### **3.5 ADJUSTING**

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

### **3.6 PROTECTION**

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

**END OF SECTION**

## **SECTION 262726**

### **WIRING DEVICES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Standard-grade receptacles, 125 V, 20 A.
  - 2. USB receptacles.
  - 3. GFCI receptacles, 125 V, 20 A.
  - 4. Toggle switches, 120/277 V, 20 A.
  - 5. Wall-box dimmers.
  - 6. Wall plates.

##### **1.3 DEFINITIONS**

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

##### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Generator fed Electrical System: Red.
  - 3. Receptacles used for charging laptops on dedicated circuits: Grey.
  - 4. SPD Devices: Blue.
  - 5. Isolated-Ground Receptacles: Orange.
- H. Wall Plate Color: For plastic covers, match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A
  - 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. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  - 2. Description: Two pole, three wire, and self-grounding.
  - 3. Configuration: NEMA WD 6, Configuration 5-20R.
  - 4. Standards: Comply with UL 498 and FS W-C-596.



B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

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. Eaton (Arrow Hart).
  - b. Hubbell Incorporated; Wiring Device-Kellems.
  - c. Leviton Manufacturing Co., Inc.
  - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

## 2.3 USB RECEPTACLES

A. USB Charging Receptacles:

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. Eaton (Arrow Hart).
  - b. Hubbell Incorporated; Wiring Device-Kellems.
  - c. Leviton Manufacturing Co., Inc.
  - d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: One USB Type A (2.4A) and one type USB Type C (3.0A), 5 V dc, per duplex receptacle (minimum).
4. Standards: Comply with UL 1310 and USB 3.0 devices.

## 2.4 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

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. Eaton (Arrow Hart).
  - b. Hubbell Incorporated; Wiring Device-Kellems.
  - c. Leviton Manufacturing Co., Inc.
  - d. Pass & Seymour/Legrand (Pass & Seymour)
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

## 2.5 TOGGLE SWITCHES, 120/277 V, 20 A

A. Switches, 120/277 V, 20 A:

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. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  2. Standards: Comply with UL 20 and FS W-S-896.
- B. Lighted Switches, 120/277 V, 20 A:
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. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  2. Description: Handle illuminated when switch is on.
  3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- C. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
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. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  2. Description: For use with mechanically held lighting contactors.
  3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

## 2.6 DIMMERS

- A. Wall-Box Dimmers:
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. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Lutron Electronics Co., Inc.
    - e. Pass & Seymour/Legrand (Pass & Seymour).
  2. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
  3. Control: Continuously adjustable slider; with single-pole or three-way switching.

4. Standards: Comply with UL 1472.
5. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
6. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 10 percent of full brightness.

## **2.7 WALL PLATES**

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
  1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
  3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
  4. Material for Damp Locations: Cast Aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install such that ground pin of vertically and horizontally mounted receptacles are on top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. If mounting horizontally, provide device such that grounding terminal is located on top and install. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
  
- B. Tests for Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
  
- C. Wiring device will be considered defective if it does not pass tests and inspections. Replace if found defective.

**END OF SECTION**

## SECTION 263323

### CENTRAL BATTERY EQUIPMENT FOR EMERGENCY LIGHTING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes the following central battery and power conversion equipment rated 600 V and less for emergency lighting:
  - 1. Interruptible (fast transfer) central battery equipment

##### 1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. IBC: International Building Code.
- C. Interruptible: As used in the Section Text, an off-line, passive-standby or line-interactive, inverter-only unit, with an intentional interruption of power to the load until an internal transfer switch picks up and transfers the load to the unit's inverter and internal battery source on loss of the "normal" source, and then retransfers to the "normal" source when it is restored. Transfer time can be "slow" (up to approximately 1 second) or "fast" (2-4 ms or 40-50 ms, depending on manufacturer).
- D. LED: Light-emitting diode.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- F. NiCd: Nickel cadmium.
- G. OCPD: Overcurrent protective device.
- H. PC: Personal computer.
- I. PWM: Pulse-width modulated.
- J. TDD: Total demand (harmonic current) distortion (also listed as "THD" in catalog data by manufacturers).
- K. THD(V): Total harmonic voltage demand.

- L. Uninterruptible: As used in the Section Text, an on-line, double-conversion (rectifier/inverter) unit, with no interruption of power to the load on interruption and restoration of the "normal" source.
- M. UPS: Uninterruptible power supply.
- N. VRLA: Valve-regulated lead acid.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type and rating of central battery equipment unit.
  - 1. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, shipping splits, and furnished options, specialties, and accessories.
- B. Shop Drawings: For each type and rating of central battery equipment unit.
  - 1. Include plans, elevations, sections, and mounting details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, ventilation requirements, method of field assembly, components, and location and size of each field connection.
  - 3. Include system one-line diagram, internal and interconnecting wiring; and diagrams for power, signal, and control wiring.
  - 4. Include elevation, details, and legends of control and indication displays.
  - 5. Include -circuit current (withstand) rating of unit.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around central battery equipment. Show central battery equipment layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- B. Qualification Data: For testing agency.
- C. Product Certificates: For each type of central battery equipment.
- D. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranty: For special warranty.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For central battery equipment to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Manufacturer's written instructions for testing central battery equipment.
    - b. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
    - c. Manufacturer's written instructions for selecting and setting field-adjustable controls and status and alarm points

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
  - 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each type.
  - 2. Output Circuit Breakers: One for every 10 of each type and rating, but no fewer than one of each type.
  - 3. Output Circuit Breaker Open/Tripped Alarm Contacts: One for every 10 supplied, but no fewer than one of each type.
  - 4. Cabinet Ventilation Filters: One complete set.
  - 5. Circuit Board: One spare circuit board for each critical circuit.

## **1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver equipment in fully enclosed vehicles.
- B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

## **1.10 FIELD CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:



1. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
  2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
  3. Humidity: More than 95 percent (condensing).
  4. Altitude: Exceeding 3300 feet.
- B. Interruption of Existing Electrical Distribution Systems: Do not interrupt electrical distribution systems within facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify Owner no fewer than seven days in advance of proposed interruption of electrical systems.
  2. Indicate method of providing temporary electrical service.
  3. Do not proceed with interruption of electrical systems without Owner's written permission.
  4. Comply with NFPA 70E.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for central battery equipment, including clearances between central battery equipment and adjacent surfaces and other items.

### 1.11 COORDINATION

- A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

### 1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace central battery equipment that fails in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.
1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:
    - a. Central Battery Equipment (excluding Batteries): Three year(s).
    - b. VRLA Batteries:
      - 1) Full Warranty: Three year(s).

## PART 2 - PRODUCTS

### 2.1 INTERRUPTIBLE (FAST-TRANSFER) CENTRAL BATTERY EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Chloride Systems.
  2. Controlled Power Company; an Emerson company.

3. Cooper Industries, Inc.
4. Crucial Power Products.
5. Dual-Lite.
6. Emergi-Lite; a Thomas & Betts brand.
7. Light-Alarm; a Thomas & Betts brand.
8. LightGuard, A Philips Group Brand.
9. Lithonia Lighting; Acuity Brands Lighting, Inc.
10. Myers Power Products, Inc.
11. Siltron Emergency Systems.
12. Thomas & Betts Corporation; A Member of the ABB Group.

B. General Requirements for Interruptible (Fast-Transfer) Central Battery Equipment:

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. NRTL Compliance: Fabricate and label central battery equipment to comply with UL 924 and UL 1778.
3. Comply with the IBC, NFPA 70, and NFPA 101.
4. Comply with NEMA PE 1.

C. Performance Requirements:

1. Fast-Transfer Central Battery Equipment: Passive standby (off-line) system. Automatically sense loss of normal ac supply and use a solid-state static switch to transfer load. Transfer in 40-50 ms or less from normal supply to battery-inverter supply.
2. Automatic Operation:
  - a. Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, bypassing inverter, with battery connected in parallel via rectifier/charger output.
  - b. Abnormal Supply Conditions: If normal ac supply deviates from specified voltage, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.
  - c. If normal power fails, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.
  - d. If a fault occurs in system when being supplied by inverter and current flows in excess of the overload rating of inverter, inverter automatically protects itself against damage from overloads and short circuits by shutting down.
  - e. When normal ac power is restored at input supply terminals of unit, controls automatically retransfer the load back to the normal ac supply, with a momentary loss of power to the load. Rectifier/charger then recharges battery.
  - f. If normal power failure is prolonged (more than 90 minutes), integral low-voltage battery protective circuit disconnects battery and prevents battery from damage due to deep discharge.
  - g. If battery becomes discharged, and when normal ac supply is again available, rectifier/charger recharges battery. When battery is fully charged, rectifier/charger automatically shifts to float-charge mode.
  - h. If battery is disconnected, and normal ac power is available, central battery equipment continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.

D. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 15 percent of central battery equipment input voltage rating.
  2. Input Frequency Tolerance: Plus or minus 5 percent of central battery equipment frequency rating.
  3. Synchronizing Slew Rate: 1 Hz per second, maximum.
  4. Minimum Off-Line Efficiency: 99 percent at 60 Hz, full load.
  5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or operating condition.
  6. Ambient Temperature Rating (Other Than Batteries): Not less than 68 deg F and not exceeding 86 deg F.
  7. Ambient Storage Temperature Rating (Other Than Batteries): Not less than minus 4 deg F and not exceeding 158 deg F.
  8. Ambient Temperature Rating (Batteries): Not less than 32 deg F and not exceeding 104 deg F.
  9. Ambient Storage Temperature Rating (Batteries): Not less than 0 deg F and not exceeding 104 deg F.
  10. Humidity Rating: Less than 95 percent (noncondensing).
  11. Altitude Rating: Not exceeding 3300 feet.
  12. Off-Line Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
- E. Inverter and Controls Logic: Microprocessor based, isolated from all power circuits; provides complete self-diagnostics, periodic automatic testing and reporting; with alarms.
- F. Controls and Indication:
1. Status Indication: Door-mounted, labeled LED indicators or digital screen displaying the following conditions:
    - a. Normal power available.
    - b. Status of system.
    - c. Battery charging status.
    - d. On battery power.
    - e. System fault.
    - f. External fault.
  2. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
    - a. Keypad: In addition to required programming and control keys, include the following:
      - 1) Keys for METER, CONTROL, PROGRAM, and CLEAR modes.
      - 2) Security Access: Provide electronic security access to controls through identification and password with at least two levels of access: View only; and view, operate, and service.
      - 3) Control Authority: Supports at least three conditions: Off, local manual control at unit and local automatic control at unit.
    - b. Digital Display: Plain-English language messages on a digital display; provide the following historical logging information and displays:
      - 1) Real-time clock with current time and date.

- 2) Tests and Events Logs: Record and store up to 25 tests and events.
  - a) Dates.
  - b) Times.
  - c) Durations.
  - d) Output voltage and currents.
  
- 3) Alarm Logs: Record and store up to 25 alarms.
  - a) Dates.
  - b) Times.
  - c) Alarm type.
  
- 4) Metering Functions: Display central battery equipment metering parameters including, but not limited to, the following:
  - a) Input and output voltage (V ac) and output current (A ac).
  - b) Battery voltage (V dc) and current (A ac).
  - c) Fault or alarming status (code).
  - d) Power output (VA).
  - e) Inverter load (W).
  - f) Ambient temperature (deg F).
  - g) System run time (cumulative days).
  - h) Inverter run time (cumulative minutes).
  
- 5) Alarm Functions: Digital display mounted flush in unit door and connected to display central battery equipment parameters including, but not limited to, the following:
  - a) High/low battery charge voltage.
  - b) High/low input voltage.
  - c) Battery nearing low-voltage condition.
  - d) Battery low voltage.
  - e) High ambient temperature.
  - f) Inverter fault.
  - g) Output fault.
  - h) Output overload.

3. Remote Signal Interfaces:

- a. Remote Indication Interface: A minimum of one programmable (Form C) dry-circuit relay output(s) (120-V ac, 2 A) for remote indication of the following:
  - 1) Fault or status indication.
  - 2) On bypass.
  - 3) Low battery.
  
- b. Communications Interface: Factory-installed hardware and software to enable a remote PC to program central battery equipment and monitor and display status and alarms.
  - 1) Communications Ports: RS-232 or RS-485 .
  - 2) Network Communications Ports: Ethernet.

- 3) Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via DDC system for HVAC RS-485 serial networks and Ethernet 10Base-T networks as a native device.

G. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide protection against damage from supply voltage surges as defined in IEEE C62.45, Category B and C.
2. Integral, programmable, self-diagnostic and self-test circuitry; with alarms and logging.
3. Battery deep-discharge and self-discharge protection; with alarms.
4. Battery self-test circuitry; with alarms and logging.

H. Integral Input Disconnecting Means and OCPD: Thermal-magnetic circuit breaker, complying with UL 489.

1. Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating: 10 kA.

I. Inverter:

1. Description: Solid-state, high-frequency, PWM type, with the following operational features:
  - a. Automatically regulate output voltage to within plus or minus 3 percent, for all load ranges and for maximum 25 percent step-load changes; regulation may increase to 8 percent for 100 percent step-load changes.
  - b. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load, at unity power factor, over the operating range of battery voltage.
  - c. Output Voltage Waveform: Sine wave with maximum 3 percent TDD throughout battery operating-voltage range, for 100 percent linear load.
  - d. Inverter Overload Capability: 115 percent for 10 minutes; 150 percent surge for 10 seconds.
  - e. Load Power Factor: 0.5 lead to 0.5 lag.
  - f. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.

J. Rectifier/Battery Charger:

1. Description: Solid state, variable rate, temperature compensated; automatically maintains batteries in fully charged condition when normal power is available.
2. Maximum Battery Recharge Time from Fully Discharged State: 24 hours.
3. Low-voltage disconnect circuit reduces battery discharge during extended power outages, monitors battery voltage, and disconnects inverter when battery voltage drops to no less than 85.7 percent of nominal voltage.

K. Batteries:

1. Description: Standard VRLA batteries.
  - a. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.
2. Battery Disconnect and OCPD: Manufacturer's standard.

## **2.2 ENCLOSURES**

- A. Central Battery Equipment Enclosures: NEMA 250, to comply with environmental conditions at installed location.
  - 1. Dry and Clean Indoor Locations: Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
  - 2. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

## **2.3 OPTIONAL AND ACCESSORY FEATURES**

- A. Factory-Installed Options and Accessories:
  - 1. Multiple-Output Voltages: Supply unit branch circuits at different voltage levels if required. Transform voltages internally as required to produce indicated output voltages.
  - 2. Split-Output Configuration: Divides output into normally on and normally off buses.
  - 3. Auto-dialer.
  - 4. Internal fax modem.
  - 5. Audible alarm with silencer switch.

## **2.4 SOURCE QUALITY CONTROL**

- A. Testing: Test and inspect central battery equipment according to UL 924.
- B. Factory Tests: Test and inspect assembled central battery equipment, by a qualified testing agency, according to UL 924. Affix standards organization's label. Include the following:
  - 1. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
  - 2. Full-load test.
  - 3. Transient-load response test.
  - 4. Overload test.
  - 5. Power failure test.
- C. Central battery equipment will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Receive, inspect, handle, and store central battery equipment according to NECA 411.
- B. Examine areas, surfaces, and substrates to receive central battery equipment, with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.
- C. Examine equipment before installation. Reject equipment that is wet, moisture damaged, or mold damaged.
- D. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Coordinate layout and installation of central battery equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install central battery equipment and accessories according to NECA 411.
- C. Wall-Mounted Central Battery Equipment: Install central battery equipment on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For units not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Comply with NECA 1.
- F. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters[ and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used for low-voltage control and alarm wiring]. Conceal raceway and cables except in unfinished spaces.
  1. Install plenum cable in environmental air spaces, including plenum ceilings.
  2. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
  3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

### **3.3 CONNECTIONS**

- A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams unless otherwise indicated.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
  - 1. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### **3.4 CONTROL WIRING INSTALLATION**

- A. Install wiring between central battery equipment and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.

### **3.5 IDENTIFICATION**

- A. Identify central battery equipment, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label central battery equipment with engraved nameplates.
  - 3. Label each separate cabinet, for multicabinet units.
  - 4. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for central battery equipment, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of central battery equipment units.

### **3.6 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
- C. Acceptance Testing Preparation:
  - 1. Inspect and Test Each Component:
    - a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
    - b. Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.



c. Test continuity of each circuit.

D. Tests and Inspections:

1. Inspect central battery equipment, wiring, components, connections, and equipment installation. Test and adjust components and equipment.
2. Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.
3. Test continuity of each circuit.
4. Verify that input voltages and frequencies at central battery equipment locations are within voltage and frequency limits specified in Part 2. If outside this range, notify Engineer before closing input OCPDs.
5. Perform each visual and mechanical inspection and electrical test stated in manufacturer's written instructions and in NETA Acceptance Testing Specification, including specifically those for batteries, battery chargers, and UPS, regardless of the type of central battery equipment provided. Certify compliance with test parameters.
6. Perform a load-duration test at rated voltage and rated output current to verify the correct functional operation of the unit under full-load stable operating conditions for the minimum time limits required by UL 924. Monitor and record ambient temperature and temperatures within the unit.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
  - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of central battery equipment. Remove front panels so joints and connections are accessible to portable scanner.
  - b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Central battery equipment will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies central battery equipment and describes all test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action. Submit to Engineer.

### 3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

### **3.8 ADJUSTING**

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, and other adjustable parts.
- C. Adjust the trip settings of thermal-magnetic circuit breakers with adjustable, instantaneous-trip elements; install fuses if not factory installed.
- D. Set the automatic system test parameters.

### **3.9 PROTECTION**

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace central battery equipment whose interiors have been exposed to water or other liquids prior to Substantial Completion.

### **3.10 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central battery equipment, and to use and reprogram microprocessor-based control, monitoring, and display functions.

**END OF SECTION**

## SECTION 265119

### LED INTERIOR LIGHTING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes the following types of LED luminaires:
  - 1. LED Light Fixtures
- B. Related Requirements:
  - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

##### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

- a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
- 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
- 1. Luminaires.
  - 2. Suspended ceiling components.
  - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
  - 4. Structural members to which equipment and luminaires will be attached.
  - 5. Initial access modules for acoustical tile, including size and locations.
  - 6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Ceiling-mounted projectors.
  - 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Product Certificates: For each type of luminaire.
- D. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Sample warranty.

### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Spare fixtures – 2 for every 100. Furnish at least one of each type on lighting fixture schedule.

## **1.8 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
  1. Obtain Architect's approval of luminaires in mockups before starting installations.
  2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## **1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Ambient Temperature: [41 to 104 deg F] [5 to 104 deg F].
  1. Relative Humidity: Zero to 95 percent.

## 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

## 2.3 FIXTURES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Albeo Technologies, Inc; A GE Company.
  - 2. Amerlux.
  - 3. Architectural Lighting Works.
  - 4. Axis Lighting, Inc.
  - 5. Cooper Lighting, an Eaton business.
  - 6. Edge Lighting.
  - 7. Edison Price Lighting.
  - 8. Eureka.
  - 9. Focal Point.
  - 10. GE Lighting Solutions.
  - 11. Juno Lighting Group by Schneider Electric.
  - 12. Lighting Science Group.
  - 13. Lightolier; a Philips group brand.
  - 14. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 15. MP Lighting.
  - 16. OSRAM SYLVANIA.
  - 17. Pure Lighting.
  - 18. Sea Gull Lighting.
  - 19. Selux Corporation.
  - 20. Specialty Lighting Industries, Inc.
  - 21. Tech Lighting.
- B. Nominal Operating Voltage: 120 V ac/277 V ac.
- C. Lamp:

1. Minimum lumens as specified in schedule.
  2. Minimum allowable efficacy: equivalent to specified fixture.
  3. CRI of 80. CCT as specified in schedule.
  4. Rated lamp life of 50,000 hours to L70.
  5. Dimmable from 100 percent to 0 percent of maximum light output.
  6. Internal driver.
  7. User-Replaceable Lamps:
    - a. Bulb shape complying with ANSI C78.79.
    - b. Lamp base complying with ANSI C81.61 or IEC 60061-1.
  8. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- D. Housings:
1. Extruded-aluminum housing and heat sink.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- F. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  2. Glass: Annealed crystal glass unless otherwise indicated.
  3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- G. With integral mounting provisions.
- H. Standards:
1. ENERGY STAR certified.
  2. RoHS compliant.
  3. UL Listing: Listed for damp or wet locations as specified. IC rated if specified.

## 2.4 MATERIALS

- A. Metal Parts:
1. Free of burrs and sharp corners and edges.
  2. Sheet metal components shall be steel unless otherwise indicated.
  3. Form and support to prevent warping and sagging.
- B. Steel:
1. ASTM A 36/A 36M for carbon structural steel.
  2. ASTM A 568/A 568M for sheet steel.
- C. Stainless Steel:
1. 1. Manufacturer's standard grade.
  2. 2. Manufacturer's standard type, ASTM A 240/240 M.

- D. Galvanized Steel: ASTM A 653/A 653M.
- E. Aluminum: ASTM B 209.

## **2.5 METAL FINISHES**

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## **2.6 LUMINAIRE SUPPORT**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

### **3.3 INSTALLATION**

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.



2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:
  - a. Two 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length.
  - b. Pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length.
  - c. Hook mount.
2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

- I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal. Test battery operation for 90 minutes.

B. Luminaire will be considered defective if it does not pass operation tests and inspections. Replace as required.

### **3.6 ADJUSTING**

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

**END OF SECTION**

## SECTION 265213

### EMERGENCY AND EXIT LIGHTING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Exit signs.
  - 2. Luminaire supports.

##### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire" Paragraph.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
  - 1. Include data on features, accessories, and finishes.
  - 2. Include physical description of the unit and dimensions.
  - 3. Battery and charger for light units.
  - 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

## 1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment will be attached.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling including the following:
  - a. Other luminaires.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
7. Moldings.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Sample Warranty: For manufacturer's warranty.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

## 1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## 1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.
- G. Bulb Shape: Complying with ANSI C79.1.

### 2.2 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 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. Amerlux.
  - b. Cooper Lighting, an Eaton business.
  - c. Evenlite, Inc.
  - d. Hubbell Industrial Lighting; Hubbell Incorporated.
  - e. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - f. Philips Lighting Company.
- 2. Operating at nominal voltage of 120 V ac/277 V ac.
  - 3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
  - 4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
  - 5. Master/Remote Sign Configurations:
    - a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply battery for power connection to remote unit.
    - b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

## 2.3 MATERIALS

### A. Metal Parts:

- 1. Free of burrs and sharp corners and edges.
- 2. Sheet metal components shall be steel unless otherwise indicated.
- 3. Form and support to prevent warping and sagging.

### B. Doors, Frames, and Other Internal Access:

- 1. Smooth operating, free of light leakage under operating conditions.
- 2. Designed to permit relamping without use of tools.
- 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

### C. Diffusers and Globes:

- 1. Glass: Annealed crystal glass unless otherwise indicated.
- 2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

### D. Housings:

- 1. Extruded aluminum housing and heat sink.
- 2. Powder coat finish.

### E. Conduit: Electrical metallic tubing, minimum 3/4 inch in diameter.

## **2.4 METAL FINISHES**

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **2.5 LUMINAIRE SUPPORT COMPONENTS**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Provide support for luminaire without causing deflection of ceiling or wall.
  - 3. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
  - 2. Attached to a minimum 20-gage backing plate attached to wall structural members.
  - 3. Attached using through bolts and backing plates on either side of wall.
  - 4. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

- B. Luminaire will be considered defective if it does not pass operation tests and inspections. Replace as required.

### 3.5 STARTUP SERVICE

- A. Perform startup service:

1. Charge batteries minimum of 24 hours and conduct 90 minute discharge test.

### 3.6 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.
  - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
2. Conduct short-duration tests on all emergency lighting.



**END OF SECTION**

## SECTION 265619

### LED EXTERIOR LIGHTING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
  - 2. Luminaire supports.

##### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaire.
  - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
    - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
    - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Wiring diagrams for power, control, and signal wiring.
7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports.

## **1.5 INFORMATIONAL SUBMITTALS**

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Structural members to which [equipment] [and] luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Product Certificates: For each type of the following:

1. Luminaire.
2. Photoelectric relay.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Sample warranty.

## **1.6 CLOSEOUT SUBMITTALS**

A. Operation and Maintenance Data: For luminaires [and photoelectric relays] to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

## **1.7 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- E. Mockups: For exterior luminaires, complete with power and control connections.
  - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
  - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

## **1.9 FIELD CONDITIONS**

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

## **1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including luminaire support components.
    - b. Faulty operation of luminaires and accessories.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: 2 year(s) from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 LUMINAIRE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. CRI of minimum 80. CCT as specified on schedule.
- F. L70 lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: 120 V ac/277 V ac.
- J. Lamp Rating: Lamp marked for outdoor use.
- K. Source Limitations: Obtain luminaires from single source from a single manufacturer.

### **2.2 LUMINAIRE TYPES**

- A. Area and Site:
  - 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. Architectural Area Lighting.
    - b. Atlas Lighting Products.
    - c. Cooper Lighting, an Eaton business.
    - d. GE Lighting Solutions.
    - e. H.E. Williams.
    - f. Juno Lighting Group by Schneider Electric.
    - g. Lightolier; a Philips group brand.
    - h. Lithonia Lighting; Acuity Brands Lighting, Inc.
    - i. RAB Lighting.
  - 2. Luminaire Shape: As specified on drawings.
  - 3. Mounting: Building.
  - 4. Luminaire-Mounting Height: 9 ft.
  - 5. Distribution: As specified on drawings.
  - 6. Diffusers and Globes: As specified on drawings.
  - 7. Housings: As specified on drawings.

## 2.3 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum or Stainless steel. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Diffusers and Globes:
  - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
  - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- G. Housings:
  - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
  - 2. Provide filter/breather for enclosed luminaires.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage and coating.
    - c. CCT and CRI for all luminaires.

## 2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
  3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
    - a. Color: Verify with architect.
- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
  2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected from manufacturer's standard catalog of colors.

## **2.5 LUMINAIRE SUPPORT COMPONENTS**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Support luminaires without causing deflection of finished surface.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### **3.4 CORROSION PREVENTION**

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.



### **3.5 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### **3.6 FIELD QUALITY CONTROL**

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
  - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
    - a. IES LM-5.
    - b. IES LM-50.
    - c. IES LM-52.
    - d. IES LM-64.
    - e. IES LM-72.
  - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections. Replace as required.

### **3.7 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

**END OF SECTION**

## SECTION 284621

### ADDRESSABLE FIRE-ALARM SYSTEMS

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Remote annunciator.
6. Addressable interface device.
7. Digital alarm communicator transmitter.
8. Network communications.

- B. Related Requirements:

1. Section 270513 "Conductors and Cables for Communications Systems" for cables and conductors for fire-alarm systems.

#### 1.3 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
  1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
  - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
  - b. Show field wiring required for HVAC unit shutdown on alarm.
  - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
  - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
  - e. Locate detectors according to manufacturer's written recommendations.
  - f. Show air-sampling detector pipe routing.
13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Record copy of site-specific software.
    - g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.
      - 3) Frequency of inspection of installed components.
      - 4) Requirements and recommendations related to results of maintenance.
      - 5) Manufacturer's user training manuals.
    - h. Manufacturer's required maintenance related to system warranty requirements.
    - i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.
- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Smoke Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.

2. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
3. Keys and Tools: One extra set for access to locked or tamper proofed components.
4. Audible and Visual Notification Appliances: two percent of amount of each type installed.
5. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

## **1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. NFPA Certification: Obtain certification according to NFPA 72.

## **1.9 PROJECT CONDITIONS**

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
  1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
  2. Do not proceed with interruption of fire-alarm service without Owner's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

## **1.10 SEQUENCING AND SCHEDULING**

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

## **1.11 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
  2. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### **2.2 SYSTEMS OPERATIONAL DESCRIPTION**

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Duct smoke detectors.
  - 5. Automatic sprinkler system water flow.
  - 6. Preaction system.
  - 7. Fire-extinguishing system operation.
  - 8. Fire standpipe system.
  - 9. Dry system pressure flow switch.
  - 10. Fire pump running.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Continuously operate alarm notification appliances.
  - 2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
  - 3. Transmit an alarm signal to the remote alarm receiving station.
  - 4. Unlock electric door locks in designated egress paths.
  - 5. Release fire and smoke doors held open by magnetic door holders.
  - 6. Activate voice/alarm communication system.
  - 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  - 8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
  - 9. Activate preaction system.
  - 10. Recall elevators to primary or alternate recall floors.
  - 11. Activate elevator power shunt trip.
  - 12. Activate emergency lighting control.
  - 13. Activate emergency shutoffs for gas and fuel supplies.
  - 14. Record events in the system memory.
  - 15. Record events by the system printer.

16. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Fire pump running.
5. Fire-pump loss of power.
6. Fire-pump power phase reversal.
7. Independent fire-detection and -suppression systems.
8. User disabling of zones or individual devices.
9. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Hose cabinet door open.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.

## **2.3 FIRE-ALARM CONTROL UNIT**

A. General Requirements for Fire-Alarm Control Unit:

1. Must be compatible with existing FACP 'SIMPLEX 4002'.
2. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
  - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.

- b. Include a real-time clock for time annotation of events on the event recorder and printer.
    - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    - d. The FACP shall be listed for connection to a central-station signaling system service.
    - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
  - 3. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
  - 4. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
  - 1. Annunciator and Display: Liquid-crystal type, Three lines of 80 characters, minimum.
  - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
  - 1. Pathway Class Designations: NFPA 72, Class A.
  - 2. Pathway Survivability: Level 0, but all vertical runs shall be in conduit.
  - 3. Serial Interfaces:
    - a. One dedicated RS 485 port for remote station operation using point ID DACT.
    - b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    - c. One RS 232 port for PC configuration.
- D. Smoke-Alarm Verification:
  - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
  - 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
  - 3. Record events by the system printer.
  - 4. Sound general alarm if the alarm is verified.
  - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- E. Notification-Appliance Circuit:
  - 1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
  - 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.



3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- F. Elevator Recall:
1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
    - a. Elevator lobby detectors except the lobby detector on the designated floor.
    - b. Smoke detector in elevator machine room.
    - c. Smoke detectors in elevator hoistway.
  2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
  3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
    - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
  1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
  1. Batteries: Sealed lead calcium or Sealed, valve-regulated, recombinant lead acid.
- L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.4 PREACTION SYSTEM

- A. Initiate Presignal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiation device connected as part of a preaction system shall be annunciated at the FACP only, without activation of the general evacuation alarm.

## 2.5 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  1. Double-action mechanism requiring two actions to initiate an alarm, with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  2. Station Reset: Key- or wrench-operated switch.
  3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

## 2.6 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
  1. Comply with UL 268; operating at 24-V dc, nominal.
  2. Detectors shall be two-wire type.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
  7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    - c. Multiple levels of detection sensitivity for each sensor.
    - d. Sensitivity levels based on time of day.
- B. Photoelectric Smoke Detectors:
  1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

## 2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- B. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  2. Mounting: Wall mounted unless otherwise indicated.
  3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  4. Flashing shall be in a temporal pattern, synchronized with other units.
  5. Strobe Leads: Factory connected to screw terminals.
  6. Mounting Faceplate: Factory finished, red.

## **2.8 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE**

- A. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit, the fire command center and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
1. Common-talk type for firefighter use only.
  2. Selective-talk type for use by firefighters and fire wardens.
  3. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. An indicator lamp shall flash if a phone is disconnected from the talk circuits.
  4. Addressable firefighters' phone modules to monitor and control a loop of firefighter phones. Module shall be capable of differentiating between normal, off-hook, and trouble conditions.
  5. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is taken off the hook, it causes an audible signal to sound and a high-intensity lamp to flash at the fire-alarm control unit.
  6. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
  7. Display: Digital to indicate location of caller.
  8. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.
    - a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Warden Phone" or "Fire Emergency Phone."
    - b. With "break-glass" type door access lock.
  9. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Warden Phone" or "Fire Emergency Phone."
  10. Handsets: 1 push-to-talk-type set with noise-canceling microphone stored in a cabinet adjacent to fire-alarm control unit.

## **2.9 REMOTE ANNUNCIATOR**

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## **2.10 ADDRESSABLE INTERFACE DEVICE**

- A. General:
1. Include address-setting means on the module.
  2. Store an internal identifying code for control panel use to identify the module type.

3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or to circuit-breaker shunt trip for power shutdown.
  1. Allow the control panel to switch the relay contacts on command.
  2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
  1. Operate notification devices.
  2. Operate solenoids for use in sprinkler service.

## **2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER**

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one of two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
  1. Verification that both telephone lines are available.
  2. Programming device.
  3. LED display.
  4. Manual test report function and manual transmission clear indication.
  5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
  1. Address of the alarm-initiating device.
  2. Address of the supervisory signal.
  3. Address of the trouble-initiating device.
  4. Loss of ac supply.
  5. Loss of power.
  6. Low battery.
  7. Abnormal test signal.
  8. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.

- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## **2.12 NETWORK COMMUNICATIONS**

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- C. Provide integration gateway using BACnet/Modbus (verify and provide) for connection to building automation system.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 EQUIPMENT INSTALLATION**

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  - 1. Connect new equipment to existing control panel in existing part of the building.
  - 2. Connect new equipment to existing monitoring equipment at the supervising station.
  - 3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- D. Manual Fire-Alarm Boxes:
  - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
  - 2. Mount manual fire-alarm box on a background of a contrasting color.
  - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- E. Smoke- or Heat-Detector Spacing:
  - 1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  - 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  - 3. Smooth ceiling spacing shall not exceed 30 feet.
  - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
  - 5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
  - 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- G. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### **3.3 PATHWAYS**

- A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
  - 1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

### **3.4 CONNECTIONS**

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
  - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
  - 3. Smoke dampers in air ducts of designated HVAC duct systems.
  - 4. Magnetically held-open doors.
  - 5. Electronically locked doors and access gates.
  - 6. Alarm-initiating connection to elevator recall system and components.
  - 7. Alarm-initiating connection to activate emergency lighting control.
  - 8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
  - 9. Supervisory connections at valve supervisory switches.
  - 10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
  - 11. Supervisory connections at elevator shunt-trip breaker.
  - 12. Data communication circuits for connection to building management system.
  - 13. Data communication circuits for connection to mass notification system.
  - 14. Supervisory connections at fire-extinguisher locations.
  - 15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
  - 16. Supervisory connections at fire-pump engine control panel.

### **3.5 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### **3.6 GROUNDING**

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

### **3.7 FIELD QUALITY CONTROL**

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.



- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### **3.8 MAINTENANCE SERVICE**

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

### **3.9 SOFTWARE SERVICE AGREEMENT**

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

### **3.10 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

**END OF SECTION**