



## **GPMTD Citylink Transit District Renovation**

Project No: 0180459.04

May 24, 2019

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**SECTION 00 0107 - SEALS PAGE**

The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Structural Engineer under the laws of the State of Illinois.

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SIGNATURE:

NAME: Adrienne K. Coussens

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

LICENSE EXPIRES: 11-30-2020

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SEAL

The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Architect under the laws of the State of Illinois.

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NAME: Douglas Roy Draeger

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The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Mechanical Engineer under the laws of the State of Illinois.

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The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Electrical Engineer under the laws of the State of Illinois.

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SIGNATURE:

NAME: Jay D. Eman

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

LICENSE EXPIRES: 11-30-2020

\_\_\_\_\_  
SEAL

**END OF SECTION 00 0107**

**SECTION 00 0115 - DRAWING INDEX**GENERAL

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**END OF SECTION 00 0115**

**SECTION 01 1000 - SUMMARY****PART 1 GENERAL****1.1. GENERAL**

- A. **If conflicts exist between the Invitation for Bids (IFB) and Project Manual Sections with the "01" prefix, the IFB shall prevail.**

**1.2. PROJECT**

- A. Project Name: GPMTD Citylink Transit Center - Renovation
- B. Owner's Name: Greater Peoria Mass Transit District.
- C. Architect's Name: Farnsworth Group, Inc. .
- D. The Project consists of the renovation of the existing transit center and associated work defined in the IFB, the Drawing Set, and Project Manual..

**1.3. CONTRACT DESCRIPTION**

- A. Contract Type: Single prime contracts based on a Stipulated Sum.

**1.4. DESCRIPTION OF RENOVATION WORK**

- A. Scope of alterations work is indicated in the Drawing Set and in the Project Manual.
- B. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- C. HVAC: Alter existing system and add new construction, keeping existing in operation.
- D. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
- E. Fire Suppression Sprinklers: Alter existing system and add new construction, keeping existing in operation.
- F. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
- G. Telephone: Alter existing system and add new construction, keeping existing in operation.
- H. Security System: Alter existing system and add new construction, keeping existing in operation.
- I. Technology System: Alter existing system and add new construction, keeping existing in operation.

**1.5. WORK BY OWNER**

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
  - 1. Movable cabinets.
  - 2. Furnishings.
  - 3. Small equipment.



**1.6. OWNER OCCUPANCY**

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Schedule the Work to accommodate Owner occupancy.

**1.7. CONTRACTOR USE OF SITE AND PREMISES**

- A. Arrange use of site and premises to allow:
  - 1. Owner occupancy.
  - 2. Use of site and premises by the public.
- B. 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.
- C. 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.

**1.8. WORK SEQUENCE**

- A. Construct Work in stages during the construction period:
  - 1. Stage 1: Half of the public lobby and half of the customer service window.
  - 2. Stage 2: Remaining half of the public lobby and half of the customer service window.
- B. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION 01 1000**

**SECTION 01 2500 - SUBSTITUTION PROCEDURES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- B. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

**1.3. DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
  - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
    - a. Unavailability.
    - b. Regulatory changes.

**1.4. REFERENCE STANDARDS**

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION****3.1. 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 provide same or equivalent maintenance service and source of replacement parts, as applicable.
  - 4. 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.
  - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
  - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:

1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
  - C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
    1. Note explicitly any non-compliant characteristics.
  - D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
    1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
  - E. Limit each request to a single proposed substitution item.
    1. Submit an electronic document, combining the request form with supporting data into single document.
- 3.2. SUBSTITUTION PROCEDURES DURING PROCUREMENT
- A. Owner will consider requests for substitutions only if submitted at least 7 days prior to the date for receipt of bids.
- 3.3. SUBSTITUTION PROCEDURES DURING CONSTRUCTION
- A. Submittal Form (after award of contract):
    1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
  - B. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- 3.4. 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.
- 3.5. 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.

**END OF SECTION 01 2500**

**SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Coordination drawings.
- H. Submittals for review, information, and project closeout.
- I. Number of copies of submittals.
- J. Requests for Interpretation (RFI) procedures.
- K. Submittal procedures.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 6000 - Product Requirements: General product requirements.
- B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

**1.3. GENERAL ADMINISTRATIVE REQUIREMENTS**

- A. Comply with requirements of Section 01 7000 - 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. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.

9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

#### 1.4. PROJECT COORDINATOR

- A. Project Coordinator: Construction Manager.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for \_\_\_\_\_ access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
  1. Requests for Interpretation.
  2. Requests for substitution.
  3. Shop drawings, product data, and samples.
  4. Test and inspection reports.
  5. Design data.
  6. Manufacturer's instructions and field reports.
  7. Applications for payment and change order requests.
  8. Progress schedules.
  9. Coordination drawings.
  10. Correction Punch List and Final Correction Punch List for Substantial Completion.
  11. Closeout submittals.

#### PART 2 PRODUCTS - NOT USED

#### PART 3 EXECUTION

##### 3.1. ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. Contractor and Architect are required to use this service.
3. It is Contractor's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, [www.adobe.com](http://www.adobe.com), or Bluebeam PDF Revu, [www.bluebeam.com](http://www.bluebeam.com)), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:

1. Newforma Info Exchange: <https://infoexchange.f-w.com/UserWeb/>. This is hosted by Farnsworth Group.

3.2. PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:

1. Owner.
2. Contractor.
3. Sub-Contractors.

C. Agenda:

1. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
2. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
3. Coordination.
4. Staging.
5. Scheduling.

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.

3.3. SITE MOBILIZATION MEETING

A. Project Coordinator will schedule meeting at the Project site prior to Contractor occupancy.

## B. Attendance Required:

1. Contractor.
2. Owner.
3. Contractor's superintendent.
4. Major subcontractors.

## C. Agenda:

1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

## 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.

## 3.4. PROGRESS MEETINGS

## A. Arrange progress meetings at intervals appropriate with the project Work with Architect, prepare agenda with copies for participants, preside at meetings.

## B. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

## C. Attendance Required:

1. Contractor.
2. Owner.
3. Contractor's superintendent.
4. Major subcontractors.

## D. 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. Maintenance of progress schedule.
  7. Planned progress during succeeding work period.
  8. Maintenance of quality and work standards.
  9. Effect of proposed changes on progress schedule and coordination.
  10. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with \_\_\_\_ copies to Architect, Owner, participants, and those affected by decisions made.

### 3.5. 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.
  1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Submit updated schedule with each Application for Payment.

### 3.6. COORDINATION DRAWINGS

- A. Provide information required by Project Coordinator for preparation of coordination drawings.
- B. Review drawings prior to submission to Architect.

### 3.7. 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.
- B. 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 using software provided by the Electronic Document Submittal Service.



- C. 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. 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.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
  - 1. 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).
  - 2. Annotations: Field dimensions and/or description of conditions which have engendered the request.
  - 3. 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.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. 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. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

### 3.8. 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. Format schedule to allow tracking of status of submittals throughout duration of construction.
  - 3. Arrange information to include scheduled date for initial submittal, specification number and title, and submittal category (for review or for information).
  - 4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

### 3.9. 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.

- 5. Mock-Ups.
- 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 01 7800 - Closeout Submittals.

### 3.10. 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.

### 3.11. 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 01 7800 - Closeout Submittals:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### 3.12. 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. Extra Copies at Project Closeout: See Section 01 7800.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
  - 1. Retained samples will not be returned to Contractor unless specifically so stated.

### 3.13. 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. 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.
4. 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. Upload submittals in electronic form to Electronic Document Submittal Service website.
5. Schedule submittals to expedite the Project, and coordinate submission of related items.
6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
7. Provide space for Contractor and Architect review stamps.
8. When revised for resubmission, identify all changes made since previous submission.
9. 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.

#### 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.

#### C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Use of reproductions of the Contract Documents in digital data form to create shop drawings is only permitted as defined by execution of Electronic Files Transfer to Contractor Agreement.
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.

### 3.14. 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 or No Exceptions Taken", or language with same legal meaning.
    - b. "Furnish as Corrected", or language with same legal meaning.
      - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
  - 2. Not Authorizing fabrication, delivery, and installation:
    - a. "Revise and Resubmit".
      - 1) Resubmit revised item, with review notations acknowledged and incorporated.
      - 2) Non-responsive resubmittals may be rejected.
    - 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. "Not Reviewed" - no further action is required from Contractor.

**END OF SECTION 01 3000**

**SECTION 01 4000 - QUALITY REQUIREMENTS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. Testing and inspection agencies and services.
- D. Contractor's design-related professional design services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Defect Assessment.

**1.2. REFERENCE STANDARDS**

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2015a, with Editorial Revision (2016).

**1.3. CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES**

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
  - 1. Concrete Mix Design: As described in Section 03 3000 - Cast-in-Place Concrete. No specific designer qualifications are required.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Include:

- a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Compliance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.
  2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- 1.5. Quality Assurance
- A. Testing Agency Qualifications:
1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- 1.6. Testing and Inspection Agencies and Services
- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

## 3.1. CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

## 3.2. MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Make corrections as necessary until Architect's approval is issued.
- H. Accepted mock-ups shall be a comparison standard for the remaining Work.
- I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

### 3.3. TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### 3.4. TESTING AND INSPECTION

- A. Testing Agency Duties:
  - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 2. Perform specified sampling and testing of products in accordance with specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 5. Perform additional tests and inspections required by Architect.
  - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  - 4. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  - 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.



- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5. DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

**END OF SECTION 01 4000**

**SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS****PART 1 GENERAL****1.1. SECTION INCLUDES**

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

**1.2. TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. **Contractor shall provide an adequate number of facilities for use by the public while the existing public restrooms are closed during construction.**
- B. Maintain daily in clean and sanitary condition.

**1.3. 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.

**1.4. 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: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

**1.5. SECURITY - See Section 01 3553**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

**1.6. VEHICULAR ACCESS AND PARKING - See Section 01 5500**

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.

### 1.7. 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.

### 1.8. REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION 01 5000**

**SECTION 01 6000 - PRODUCT REQUIREMENTS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Transportation, handling, storage and protection.
- B. Product option requirements.
- C. Substitution limitations.
- D. Procedures for Owner-supplied products.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 23 0513 - Common Motor Requirements for HVAC Equipment: Motors for HVAC equipment.

**1.3. REFERENCE STANDARDS**

- A. NEMA MG 1 - Motors and Generators; 2017.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4. 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****2.1. NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Motors: Refer to Section 23 0513 - Common Motor Requirements for HVAC Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

## 2.2. 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.

## 2.3. 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

### 3.1. SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

### 3.2. OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. On delivery, inspect products jointly with Contractor.
  - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
  - 1. Review Owner reviewed shop drawings, product data, and samples.
  - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
  - 3. Handle, store, install and finish products.
  - 4. Repair or replace items damaged after receipt.

### 3.3. 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.

#### 3.4. STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
- 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. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Prevent contact with material that may cause corrosion, discoloration, or staining.
- K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- L. 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 01 6000**

**SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, \_\_\_\_\_.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.
- F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- G. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.

- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

#### 1.4. QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in Illinois and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

#### 1.5. 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 property.
  - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
  - 2. 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.

#### 1.6. COORDINATION

- A. See Section 01 1000 for occupancy-related requirements.
- B. 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.
- C. Notify affected utility companies and comply with their requirements.
- D. 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.
- E. 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.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.



- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## PART 2 PRODUCTS

### 2.1. 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 01 6000 - Product Requirements.

## PART 3 EXECUTION

### 3.1. 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.

### 3.2. 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.

### 3.3. PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.

- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. 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.

### 3.4. LAYING OUT THE WORK

- A. Promptly notify Architect of any discrepancies discovered.

### 3.5. GENERAL INSTALLATION REQUIREMENTS

- A. 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.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### 3.6. 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 01 5000 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.
  - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- 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, Telecommunications, and \_\_\_\_\_): 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. See Section 01 1000 for other limitations on outages and required notifications.
    - c. 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. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- 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. Comply with all other applicable requirements of this section.

### 3.7. 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. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- I. 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.

### 3.8. 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.

### 3.9. 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. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### 3.10. SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### 3.11. DEMONSTRATION AND INSTRUCTION

- A. See Section 01 7900 - Demonstration and Training.

### 3.12. ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

### 3.13. FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. 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.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### 3.14. CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
  - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. 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.
- E. 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.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Accompany Project Coordinator on Contractor's preliminary final inspection.

- H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

### 3.15. MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION 01 7000**

**SECTION 01 7800 - CLOSEOUT SUBMITTALS****PART 1 GENERAL****1.1. SECTION INCLUDES**

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

**1.2. RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - 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.

**1.3. 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****3.1. 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.
  6. Manufacturer's instruction for assembly, installation, and adjusting.
- 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. Manufacturer's name and product model and number.
  2. Product substitutions or alternates utilized.
  3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
  2. Details not on original Contract drawings.

### 3.2. OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. 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.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### 3.3. 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.

### 3.4. 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. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. 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.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Include test and balancing reports.
- O. Additional Requirements: As specified in individual product specification sections.

### 3.5. ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals 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 tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. 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.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. 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.
    - e. Photocopies of warranties and bonds.

### 3.6. 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. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

**END OF SECTION 01 7800**

**SECTION 01 7900 - DEMONSTRATION AND TRAINING****PART 1 GENERAL****1.1. SUMMARY**

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Items specified in individual product Sections.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit to Architect for transmittal to Owner.
  - 2. Submit not less than four weeks prior to start of training.
  - 3. Revise and resubmit until acceptable.
  - 4. Provide an overall schedule showing all training sessions.
  - 5. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such as slides, hand-outs, etc.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:

1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.

1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.4. QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1. DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.

### 3.2. TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  - 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
  - 1. Review the applicable O&M manuals.
  - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
  - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  - 6. Discuss common troubleshooting problems and solutions.
  - 7. Discuss any peculiarities of equipment installation or operation.
  - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  - 10. Review spare parts and tools required to be furnished by Contractor.
  - 11. Review spare parts suppliers and sources and procurement procedures.
- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION 01 7900**

**SECTION 02 4100 - DEMOLITION****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Selective demolition of building elements for alteration purposes.
- B. Abandonment and removal of existing utilities and utility structures.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

**PART 3 EXECUTION****2.1. SCOPE**

- A. Remove other items indicated, for new work.

**2.2. GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 5. Do not close or obstruct roadways or sidewalks without permit.
  - 6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.



1. Provide bracing and shoring.
  2. Prevent movement or settlement of adjacent structures.
  3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

### 2.3. EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not close, shut off, or disrupt existing life safety systems that are in use without prior notification to Owner.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without prior notification to Owner.
- E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

### 2.4. SELECTIVE DEMOLITION FOR 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 demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
- C. Remove existing work as indicated and as required to accomplish new work.
1. Remove items indicated on drawings.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and \_\_\_\_\_): Remove existing systems and equipment as indicated.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.

2. 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.
  3. 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.
- E. 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.
  4. Patch as specified for patching new work.
- 2.5. DEBRIS AND WASTE REMOVAL
- A. Remove debris, junk, and trash from site.
  - B. Leave site in clean condition, ready for subsequent work.
  - C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION 02 4100**

**SECTION 04 0511 - MORTAR AND MASONRY GROUT****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Mortar for masonry.
- B. Grout for masonry.

**1.2. RELATED REQUIREMENTS**

- A. Section 04 2600 - Single-Wythe Unit Masonry: Installation of mortar and grout.

**1.3. REFERENCE STANDARDS**

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2018.
- C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2018.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- F. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- I. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2018.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

**1.5. QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

## 1.7. FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

## PART 2 PRODUCTS

### 2.1. MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Mortar Mix Designs: ASTM C270, Property Specification.
  - 1. Interior, Non-loadbearing Masonry: Type O.
- C. Grout Mix Designs:
  - 1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
  - 2. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.

### 2.2. MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
  - 1. Color: Standard gray.
- B. Portland Cement: ASTM C150/C150M.
  - 1. Type: Type I - Normal; ASTM C150/C150M.
  - 2. Color: Standard gray.
- C. Masonry Cement: ASTM C91/C91M.
  - 1. Type: Type N; ASTM C91/C91M.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Quicklime: ASTM C5, non-hydraulic type.
- F. Mortar Aggregate: ASTM C144.
- G. Grout Aggregate: ASTM C404.
- H. Water: Clean and potable.

### 2.3. MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

- B. Maintain sand uniformly damp immediately before the mixing process.
- C. If water is lost by evaporation, re-temper only within two hours of mixing.

#### 2.4. GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

### PART 3 EXECUTION

#### 3.1. INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

#### 3.2. GROUTING

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.
- B. Low-Lift Grouting:
  - 1. Limit height of pours to 12 inches.
  - 2. Limit height of masonry to 16 inches above each pour.
  - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
  - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. High-Lift Grouting:
  - 1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
  - 2. Hollow Masonry: Limit lifts to maximum 4 feet and pours to maximum height of 24 feet.
  - 3. Place grout for spanning elements in single, continuous pour.

**END OF SECTION 04 0511**

**SECTION 04 2600 - SINGLE-WYTHER UNIT MASONRY****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 04 0511 - Mortar and Masonry Grout: Mortar and grout for single wythe unit masonry.
- B. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

**1.3. REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2018.
- C. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2016.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- H. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.
- I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- J. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.
- K. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- L. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.
- M. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2017a.
- N. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.
- O. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

- P. UL (FRD) - Fire Resistance Directory; Current Edition.

#### 1.4. DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

#### 1.5. FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

### PART 2 PRODUCTS

#### 2.1. CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on drawings for specific locations.
  - 2. Non-Loadbearing Units: ASTM C129.
    - a. Hollow block, as indicated.
    - b. Lightweight.

#### 2.2. MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 0511.

#### 2.3. REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
  - 1. Blok-Lok Limited; \_\_\_\_\_: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
  - 2. Hohmann & Barnard, Inc; \_\_\_\_\_: [www.h-b.com/#sle](http://www.h-b.com/#sle).
  - 3. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) yield strength, deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
  - 1. Type: Truss or ladder.
  - 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3.

3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
- E. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A153/A153M, Class B.
- F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.
  1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A153/A153M, Class B.
  2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A153/A153M, Class B.

## 2.4. ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
  1. Manufacturers:
    - a. Blok-Lok Limited; \_\_\_\_\_: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
    - b. Hohmann & Barnard, Inc; \_\_\_\_\_: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - c. WIRE-BOND; \_\_\_\_\_: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; \_\_\_\_\_ inch wide x by maximum lengths available.
  1. Manufacturers:
    - a. Hohmann & Barnard, Inc; \_\_\_\_\_: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - b. WIRE-BOND; \_\_\_\_\_: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Building Paper: ASTM D226/D226M, Type I ("No. 15") asphalt felt.
- D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.



### 3.2. PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### 3.3. COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.

### 3.4. PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

### 3.5. REINFORCEMENT AND ANCHORAGE

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.

- D. Lap joint reinforcement ends minimum 6 inches.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches horizontally and 16 inches vertically.
- F. Install anchors to structural framing at not more than 16 inches on center.

### 3.6. LINTELS

- A. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
  - 1. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.
  - 2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
  - 3. Openings over 78 inches: Reinforce openings as detailed.
  - 4. Do not splice reinforcing bars.
  - 5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
  - 6. Place and consolidate grout fill without displacing reinforcing.
  - 7. Allow masonry lintels to attain specified strength before removing temporary supports.
- B. Maintain minimum 8 inch bearing on each side of opening.

### 3.7. CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Size control joints as indicated on drawings; if not shown, 3/4 inch wide and deep.

### 3.8. BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### 3.9. TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation from Alignment of Columns: 1/4 inch.

- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- G. Maximum Variation of Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### 3.10. CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### 3.11. CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Clean soiled surfaces with cleaning solution.
- C. Use non-metallic tools in cleaning operations.

### 3.12. PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION 04 2600**

**SECTION 06 1000 - ROUGH CARPENTRY****PART 1 GENERAL****1.1. REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- D. PS 20 - American Softwood Lumber Standard; 2015.
- E. SPIB (GR) - Grading Rules; 2014.

**1.2. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

**1.3. DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

**PART 2 PRODUCTS****2.1. GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
  - 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.
- B. Lumber fabricated from old growth timber is not permitted.

**2.2. 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.

### 2.3. ACCESSORIES

#### A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

## PART 3 EXECUTION

### 3.1. 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.

### 3.2. 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 framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. 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.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. 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. Chalkboards and marker boards.
  8. Wall paneling and trim.
  9. Joints of rigid wall coverings that occur between studs.

## END OF SECTION 06 1000



**SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.
- C. Factory finishing.
- D. Preparation for installing utilities.

**1.2. RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 09 9123 - Interior Painting: Field finishing of cabinet exterior.
- C. Section 12 3600 - Countertops.

**1.3. REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.
- D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - 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.

**1.5. QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
  - 2. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:

1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
5. Replace, repair, or rework all work for which certification is refused.

#### 1.6. DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

#### 1.7. 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

#### 2.1. MANUFACTURERS

- A. Merillat - Classic Collection, or approved equal..
- B. Substitutions: See Section 01 6000 - Product Requirements.
- C. Single Source Responsibility: Provide and install this work from single fabricator.

#### 2.2. CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Wood Veneer Faced Cabinet:
  1. Exposed Surfaces: HPVA HP-1 Grade A, Ash, plain sliced, random-matched.
  2. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Ash, plain sliced, random-matched.
  3. Concealed Surfaces: Manufacturer's option.

#### 2.3. WOOD-BASED COMPONENTS

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

#### 2.4. ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
  1. Manufacturers:
    - a. Franklin International, Inc; Titebond Original Wood Glue: [www.titebond.com/#sle](http://www.titebond.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fasteners: Size and type to suit application.



- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.
- E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

## 2.5. HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Countertop Supports:
  - 1. Material: Aluminum
  - 2. Finish/Color: Clear anodized.
  - 3. Manufacturers:
    - a. Rakks/Rangine Corporation; Cleat Supports: [www.rakks.com/#sle](http://www.rakks.com/#sle)
    - b. Rakks/Rangine Corporation; Sill Supports: [www.rakks.com/#sle](http://www.rakks.com/#sle)
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
- D. Sliding Door Pulls: Circular shape for recessed installation, steel with satin finish.
- E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- F. Catches: Magnetic.
- G. Drawer Slides:
  - 1. Type: Extension types as indicated.
  - 2. Static Load Capacity: Commercial grade.
  - 3. Mounting: Side mounted.
  - 4. Stops: Integral type.
- H. Drawer Systems: Integrated drawer slide and side.
  - 1. Side Type: Single Wall.
  - 2. Drawer Side Height: 3-1/2 inches.
  - 3. Drawer Length: 16 inch.
  - 4. Extension Type: Extension types as indicated.
  - 5. Static Load Capacity: Residential/Light Commercial grade.
  - 6. Mounting: Side mounted.
  - 7. Stops: Integral type.
- I. Hinges: European style concealed self-closing type, steel with polished finish.

- J. Soft Close Adapter: Concealed, frame-mounted, screw-adjustable damper ; steel with polished finish.

## 2.6. 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. Locate counter butt joints minimum 2 feet from sink cut-outs.

## 2.7. SHOP FINISHING

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. Sheen: Flat.
  - 2. Opaque:
    - a. Color: As selected by Architect.
    - b. Sheen: Flat.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify adequacy of backing and support framing.

### 3.2. INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Secure cabinets to floor using appropriate angles and anchorages.

### 3.3. ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4. CLEANING

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

**END OF SECTION 06 4100**

**SECTION 07 9200 - JOINT SEALANTS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 08 8000 - Glazing: Glazing sealants and accessories.
- B. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- C. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

**1.3. REFERENCE STANDARDS**

- A. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.
- B. ASTM C834 - Standard Specification for Latex Sealants; 2014.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2000 (Reapproved 2011).
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
- H. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.
- I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

**1.4. SUBMITTALS**

- A. See Section 01 3000 - 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.
  5. Substrates for which use of primer is required.
  6. Substrates for which laboratory adhesion and/or compatibility testing is required.
  7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
  8. Sample product warranty.
  9. Certification by manufacturer indicating that product complies with specification requirements.
- 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.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

#### 1.5. QUALITY ASSURANCE

- A. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

#### 1.6. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- 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.
- D. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Verify available warranties and warranty periods with manufacturers listed in Part 2 articles.
  2. Warranty Period: Two years from date of Substantial Completion.
- E. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  2. Disintegration of joint substrates from natural causes exceeding design specifications.
  3. Mechanical damage caused by individuals, tools, or other outside agents.
  4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 PRODUCTS

### 2.1. MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  - 1. Retain subparagraph below if sealants are indicated for Use I. Revise if a liquid other than water is used in testing.
  - 2. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.2. MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  - 1. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  - 2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 3. Dow Corning Corporation: [www.dowcorning.com/construction/#sle](http://www.dowcorning.com/construction/#sle).
  - 4. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 5. Sika Corporation: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - 6. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
  - 1. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  - 2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 3. Dow Corning Corporation: [www.dowcorning.com/construction/#sle](http://www.dowcorning.com/construction/#sle).
  - 4. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 5. Sika Corporation: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - 6. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 7. Substitutions: See Section 01 6000 - Product Requirements.

### 2.3. 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. Gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
    - 1) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
  - c. 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. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.

1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

#### C. Interior Wet Areas: Bathrooms, restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

#### D. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

### 2.4. JOINT SEALANTS - GENERAL

#### A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 6116.

#### B. Colors: As indicated on drawings.

### 2.5. NONSAG JOINT SEALANTS

#### A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

4. Color: Match adjacent finished surfaces.
  5. Cure Type: Single-component, neutral moisture curing.
  6. Service Temperature Range: Minus 65 to 180 degrees F.
- B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Cure Type: Single-component, neutral moisture curing
  4. Service Temperature Range: Minus 65 to 180 degrees F.
- C. 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: Clear.
- D. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Service Temperature Range: Minus 40 to 180 degrees F.
- E. 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: Match adjacent finished surfaces.
  3. Service Temperature Range: Minus 40 to 180 degrees F.
- F. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Service Temperature Range: Minus 40 to 180 degrees F.
- G. 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 standard range.
  2. Grade: ASTM C834; Grade - Minus 18 Degrees C.
- H. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding.
1. Manufacturers:



- a. Basis of Design: Tremco; TremPro JS-773.
- b. Substitutions: See Section 01 6000 - Product Requirements.

## 2.6. 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. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
  - 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
  - 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
  - 1. Size: 1 inch wide, in rolls 100 feet long.
  - 2. Thickness: 0.78 inch, with ridges along outside bottom edges for bonding area.
  - 3. Color: As selected by Architect..
- C. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- D. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- E. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- F. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

## PART 3 EXECUTION

### 3.1. 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.

### 3.2. 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.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

### 3.3. 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. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. 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.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

### 3.4. FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

### 3.5. POST-OCCUPANCY

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

## END OF SECTION 07 9200

**SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.

**1.2. RELATED REQUIREMENTS**

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9123 - Interior Painting: Field painting.

**1.3. ABBREVIATIONS AND ACRONYMS**

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

**1.4. REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- K. ITS (DIR) - Directory of Listed Products; current edition.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- N. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- O. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products; 2014.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- R. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.
- S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
- T. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- U. UL (DIR) - Online Certifications Directory; Current Edition.
- V. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- X. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

#### 1.5. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.

#### 1.6. QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

#### 1.8. PROJECT CONDITIONS

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

#### 1.9. COORDINATION

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

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Hollow Metal Doors and Frames:
  - 1. Ceco Door, an Assa Abloy Group company; \_\_\_\_: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Curries, an Assa Abloy Group company; \_\_\_\_: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Curries, an Assa Abloy Group company.
  - 4. Steelcraft, an Allegion brand; \_\_\_\_: [www.allegion.com/#sle](http://www.allegion.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.2. PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
  4. Door Edge Profile: Manufacturers standard for application indicated.
  5. Typical Door Face Sheets: Flush.
  6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.
  7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### 2.3. HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
  2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
  3. Door Thickness: 1-3/4 inch, nominal.
- C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.

- b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
  - c. Model 1 - Full Flush.
  - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
- 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
- 3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
  - a. Attach fire rating label to each fire rated unit.
- 4. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following:
  - a. Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
  - b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
  - c. Label: Include the "S" label on fire-rating label of door.
- 5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
- 6. Door Thickness: 1-3/4 inch, nominal.

#### 2.4. HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Same as hollow metal door.
- C. Interior Door Frames, Non-Fire Rated: Face welded type.
- D. Door Frames, Fire-Rated: Face welded type.
  - 1. Fire Rating: Same as door, labeled.
  - 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.
  - 1. Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.
  - 2. All frames in masonry and concrete construction shall be back primed with manufacturer's standard bitumastic coating.

- I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

## 2.5. FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

## 2.6. ACCESSORIES

- A. Glazing: As specified in Section 08 8000.
- B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### 3.2. PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### 3.3. INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 08 7100.
- F. Comply with glazing installation requirements of Section 08 8000.

### 3.4. TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.



3.5. ADJUSTING

- A. Adjust for smooth and balanced door movement.

**END OF SECTION 08 1113**

**SECTION 08 3100 - ACCESS DOORS AND PANELS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Wall and ceiling access door and frame units.

**1.2. RELATED REQUIREMENTS**

- A. Section 08 7100 - Door Hardware: Mortise cylinder and core hardware.
- B. Section 09 9123 - Interior Painting: Field paint finish.
- C. Section 23 3300 - AIR DUCT ACCESSORIES: Access doors in ductwork.

**1.3. REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2018.
- D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.
- F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- G. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018.
- H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- J. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012.
- K. FM (AG) - FM Approval Guide; current edition.
- L. ITS (DIR) - Directory of Listed Products; current edition.
- M. UL (FRD) - Fire Resistance Directory; Current Edition.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.
- E. Project Record Documents: Record actual locations of each access unit.

## PART 2 PRODUCTS

### 2.1. ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
  - 1. Location: As indicated on drawings.
  - 2. Material: Steel.
  - 3. Size: 12 inch by 12 inch.
  - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  - 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
  - 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- B. Wall-Mounted Units in Wet Areas:
  - 1. Location: As indicated on drawings.
  - 2. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
  - 3. Size: 12 inch by 12 inch.
  - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  - 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
  - 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- C. Fire-Rated Wall-Mounted Units:
  - 1. Wall Fire-Rating: As indicated on drawings.
  - 2. Size: 12 inch by 12 inch.
- D. Ceiling-Mounted Units:
  - 1. Location: As indicated on drawings.
  - 2. Material: Steel.
  - 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
  - 4. Size - Other Ceilings: 12 inch by 12 inch.
  - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

## E. Fire-Rated Ceiling-Mounted Units:

1. Ceiling Fire-Rating: As indicated on drawings.
2. Size: 12 inch by 12 inch.

## 2.2. WALL AND CEILING MOUNTED UNITS

## A. Manufacturers:

1. Activar Construction Products Group - JL Industries; \_\_\_\_\_: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
2. ACUDOR Products Inc: [www.acudor.com/#sle](http://www.acudor.com/#sle).
3. Babcock-Davis; \_\_\_\_\_: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
4. Cendrex, Inc: [www.cendrex.com/#sle](http://www.cendrex.com/#sle).

## B. 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. Frames: 16 gage, 0.0598 inch, minimum thickness.
4. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
5. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
  - a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
  - b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
6. Steel Finish: Primed.
7. Primed and Factory Finish: Polyester powder coat; color \_\_\_\_\_.
8. Door/Panel Size: As indicated on the drawings.
9. Hardware:
  - a. Hardware for Fire-Rated Units: As required for listing.
  - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
  - c. Handle: Fixed.
  - d. Latch/Lock: Tamperproof tool-operated cam latch.

## PART 3 EXECUTION

## 3.1. 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.

### 3.2. 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.

### 3.3. 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 08 3100**

**SECTION 08 3313 - COILING COUNTER DOORS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Non-fire-rated coiling counter doors and operating hardware.

**1.2. RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Rough openings.
- B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 09 2116 - Gypsum Board Assemblies: Rough openings.
- D. Section 09 9123 - Interior Painting: Field paint finish.

**1.3. REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.
- C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 4 inch long, illustrating shape, color and finish texture.
- E. Manufacturer's Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.
- F. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Coiling Counter Doors:

1. Raynor Garage Doors; \_\_\_\_: [www.raynor.com/#sle](http://www.raynor.com/#sle).
2. Wayne Dalton Garage Doors: [www.wayne-dalton.com](http://www.wayne-dalton.com).
3. Substitutions: See Section 01 6000 - Product Requirements.

## 2.2. COILING COUNTER DOORS

- A. Coiling Counter Doors, Non-Fire-Rated: Aluminum slat curtain.
1. Mounting: Between jambs, within prepared opening.
  2. Nominal Slat Size: 1-1/4 inches wide.
  3. Slat Profile: Flat; Non-perforated.
  4. Finish, Aluminum: Anodized.
  5. Guides: Formed track; same material and finish unless otherwise indicated.
  6. Hood Enclosure: Manufacturer's standard; primed steel.
  7. Manual hand chain lift operation.
  8. Locking Devices: Lock and latch handle on outside.

## 2.3. MATERIALS

- A. Curtain Construction: Interlocking, single thickness slats.
1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
  2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
  3. Aluminum Slats: ASTM B221 (ASTM B221M), aluminum alloy Type 6063; minimum thickness 0.05 inch.
- B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
1. Aluminum Guides: Extruded aluminum channel, with wool pile runners along inside.
- C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
- D. Lock Hardware:
1. Latchset Lock Cylinders: Standard mortise cylinder type; keyed differently.
    - a. Keying: Differently.
  2. Latch Handle: Manufacturer's standard.
- E. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that opening sizes, tolerances and conditions are acceptable.

**3.2. INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

**3.3. TOLERANCES**

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

**3.4. ADJUSTING**

- A. Adjust operating assemblies for smooth and noiseless operation.

**3.5. CLEANING**

- A. Clean installed components.
- B. Remove labels and visible markings.

**END OF SECTION 08 3313**



## SECTION 08710 - DOOR HARDWARE

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Commercial door hardware.
  - 2. Cylinders for doors specified in other Sections.

## 1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Include details of electrified door hardware and wiring diagrams.
- C. Samples: For each exposed finish.
- D. Door Hardware Schedule: Organized into door hardware sets indicating type, style, function, size, label, hand, manufacturer, fasteners, location, and finish of each door hardware item. Include description of each electrified door hardware function, including sequence of operation.
- E. Keying Schedule: Detail Owner's final keying instructions for locks.
- F. Product certificates.

## 1.3 QUALITY ASSURANCE

- A. Supplier Qualifications: Person who is or employs a qualified DHI Architectural Hardware Consultant.
- B. Source Limitations: Obtain electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.
- C. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying schedule.
- D. Pre-Installation Conference: Conduct conference at Project site.
- E. Keys: Deliver keys to Owner by registered mail.
- F. Templates: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware.
- G. Standards: Comply with BHMA A156 series standards, Grade 1.
- H. Certified Products: Provide door hardware that is listed in BHMA directory of certified products.

#### 1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within warranty period from date of Substantial Completion.
1. Warranty Period for Manual Closers: 10 years.
  2. Warranty Period for Exit Devices: 10 years.
  3. Warranty Period for Locks: 10 years.
  4. All other hardware one year.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Product: Subject to compliance with requirements, provide the product named for each door hardware item indicated in Door Hardware Sets.
- B. Basis-of-Design Product: Product named for each door hardware item indicated in Door Hardware Sets establishes the basis of design. Provide either the named product or a comparable product by one of the manufacturers specified for each type of hardware item.
- C. Manufacturers Used in the specification:

<b><u>Products</u></b>	<b><u>Manufacture Specified</u></b>	<b><u>Acceptable Equals</u></b>
Hinges	Ives	Hager, Stanley
Continuous Hinges	Ives	Roton, Select
Locksets	Falcon T	Schlage ND, BEST 9K, Sargent 10-Line
Closers	Falcon SC71A	LCN 4050, Norton, Sargent
Cylinders	Match Existing	

#### 2.2 DOOR HARDWARE

- A. Scheduled Door Hardware: Provide door hardware according to Door Hardware Sets at the end of Part 3. Manufacturers' names are abbreviated.

#### 2.3 HINGES

- A. General: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Hinge Base Metal: Unless otherwise indicated, provide the following:
1. Exterior Hinges: Stainless steel, with stainless-steel pin.
  2. Interior Hinges: Steel, with steel pin.
  3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

- C. Non-removable Pins: Provide set screw in hinge barrel that prevents removal of pin while door is closed; for out-swinging exterior doors.
- D. Screws: Phillips flat-head screws; screw heads finished to match surface of hinges.
- E. Metal Doors and Frames: Machine screws (drilled and tapped holes).

## 2.4 MECHANICAL LOCKS AND LATCHES

- A. Cylindrical Locks:
  - 1. Locks shall be ANSI A156.2, Series 4000 Grade 1 UL Listed for 3-hour doors. Manufactured from heavy gauge cold rolled steel mechanisms that are corrosion treated for normal conditions.
  - 2. Locks to have standard 2-3/4" backset with a full 1/2" reversible dead latch. Thru-bolted mounting post for positive interlock to the door with concealed mounting screws.
  - 3. Lever trim shall be pressure cast zinc to match finishes. The design specified, with 3-7/16" diameter roses. Trim shall be applied by "no exposed screws".

## 2.5 CLOSERS

- A. Surface-Mounted Closers:
- B. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and back check.
- C. All closers will not be seen on the public side or hallway side of the door. The appropriate drop plate or mounting plates will be used as conditions dictate.

## 2.6 STOPS AND HOLDERS

- A. Stops and Holders: Provide floor stops for doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Silencers for Door Frames: Neoprene or rubber; fabricated for drilled-in application to frame.

## 2.7 DOOR GASKETING AND THRESHOLDS

- A. Door Gasketing: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

## 2.8 CYLINDERS, KEYING, AND STRIKES

- A. Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
- B. Keying System: Match existing.

## 2.9 FABRICATION

- A. Base Metals: Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials if different from specified standard.
- B. Fasteners: Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated. Provide steel machine or wood screws or steel through bolts for fire-rated applications.
- C. Spacers or Sex Bolts: For through bolting of hollow metal doors.
- D. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."
- E. Finishes: Comply with BHMA A156.18.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine doors and frames for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- B. Steel Door and Frame Preparation: Comply with DHI A115 series. Drill and tap doors and frames for surface-applied hardware according to SDI 107.
- C. Wood Door Preparation: Comply with DHI A115-W series.
- D. Mounting Heights: Comply with the following requirements, unless otherwise indicated:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- E. Adjust and reinforce attachment substrates as necessary for proper installation and operation. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
  - 1. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with accessibility requirements.
  - 1. Door Closers: Adjust sweep period so that from an open position of 70 degrees, the door will take at least three seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

## 3.2 FIELD QUALITY CONTROL

- A. Inspections: Contractor to engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports. Provide report to architect.

## 3.3 DOOR HARDWARE SETS

**Hardware Set # 1 - NOT USED****Hardware Set # 2**

103-1                      204-1                      205-1

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	T561P6 DANE	626	FAL
1	EA	SURFACE CLOSER	SC71 RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**Hardware Set # 3**

109-1

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581P6 DANE	626	FAL
1	EA	SURFACE CLOSER	SC71 RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**Hardware Set # 4**

203-1

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581P6 DANE	626	FAL
1	EA	SURFACE CLOSER	SC71 SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

**Hardware Set # 5**

201-1

202-1

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRY / OFFICE LOCK	T511P6 DANE	626	FAL
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	SC71 RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

**Hardware Set # 6**

104-1

105-1

106-1

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	T301S DAN	626	FAL
1	EA	SURFACE CLOSER	SC71 RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**Hardware Set # 7**

205-2

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	RIM CYLINDER	AS REQUIRED	626	FAL
	EA	NOTE	REMAINDER OF HARDWARE BY DOOR MANUFACTURER		

**END OF SECTION 08 7100**

**SECTION 08 8000 - GLAZING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Glass.
- B. Glazing compounds and accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

**1.3. REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- I. GANA (GM) - GANA Glazing Manual; 2008.
- J. GANA (SM) - GANA Sealant Manual; 2008.
- K. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- L. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

### 1.5. FIELD CONDITIONS

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

### 1.6. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

## PART 2 PRODUCTS

### 2.1. GLAZING UNITS

- A. Type GL1 - Single Vision Glazing:
  - 1. Application: All interior glazing unless otherwise indicated.
  - 2. Type: Annealed float glass.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch.
- B. Type GL2 - Single Safety Glazing: Non-fire-rated.
  - 1. Application: Provide this type of glazing in the following locations:
    - a. Glazed lites in doors, except fire doors.
    - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
    - c. Other locations required by applicable federal, state, and local codes and regulations.
    - d. Other locations indicated on the drawings.
  - 2. Type: Fully tempered float glass as specified.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch.

### 2.2. GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless noted otherwise.
  - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
  - 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
  - 3. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

### 2.3. GLAZING COMPOUNDS

- A. Butyl Sealant, Type \_\_\_\_: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.



- B. Polysulfide Sealant, Type \_\_\_\_: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- C. Polyurethane Sealant, Type \_\_\_\_: Single component, chemical curing, non-staining, non-bleeding; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; \_\_\_\_\_ color.
- D. Silicone Sealant, Type \_\_\_\_: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; \_\_\_\_\_ color.

#### 2.4. GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 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 x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.
  - 1. Width: As required for application.
  - 2. Thickness: As required for application.
  - 3. Spacer Rod Diameter: As required for application.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

#### 3.2. PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.
- D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
- E. Install sealants in accordance with manufacturer's instructions.

#### 3.3. INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.

- 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 tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
- E. Fill gaps between pane and applied stop with \_\_\_\_\_ type sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

#### 3.4. CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

**END OF SECTION 08 8000**

**SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES****PART 1 GENERAL****1.1. SECTION INCLUDES**

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

**1.2. REFERENCE STANDARDS**

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
- C. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014, with Editorial Revision (2015).
- 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; 2017.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2018a.
- J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- K. 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; 2016.

- L. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- M. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets; 2017.
- N. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2017a.
- O. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- Q. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- R. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

### 1.3. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

## PART 2 PRODUCTS

### 2.1. GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

### 2.2. METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. Clarkwestern Dietrich Building Systems LLC.
  - 2. Marino.
- B. Non-Loadbearing 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 5 psf.
  - 1. Studs: "C" shaped with flat or formed webs with knurled faces.
  - 2. Runners: U shaped, sized to match studs.
  - 3. Ceiling Channels: C-shaped.

4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
5. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- D. 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.
  3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
  4. Deflection and Firestop Track:
    - a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

### 2.3. BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  1. American Gypsum Company.
  2. CertainTeed Corporation.
  3. LaFarge North America, Inc.
  4. National Gypsum Company.
  5. USG Corporation.
- B. 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. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
- C. Backing Board For Wet Areas: One of the following products:
  1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
  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 A108/A118/A136.1 or ASTM C1325.
    - a. Thickness: 1/2 inch.
    - b. Products:

- 1) Custom Building Products: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
  - 2) National Gypsum Company: [www.nationalgypsum.com](http://www.nationalgypsum.com).
  - 3) USG Corporation: [www.usg.com](http://www.usg.com).
3. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
- a. Thickness: 1/2 inch.
  - b. Products:
    - 1) James Hardie Building Products, Inc: [www.jameshardie.com](http://www.jameshardie.com).

## 2.4. ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: \_\_\_\_\_ inch.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Architectural Reveal Beads:
    - a. Reveal Depth: 1/4 inch.
    - b. Reveal Width: 1/4 inch.
    - c. Shapes: As shown on drawings.
  2. Expansion Joints: V-shaped PVC with tear away fins.
- D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
1. Ready-mixed vinyl-based joint compound.
- 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 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

## PART 3 EXECUTION

### 3.1. EXAMINATION

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

### 3.2. 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.
  - 1. Level ceiling system to a tolerance of 1/1200.
  - 2. Laterally brace entire suspension system.
  - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center.
  - 1. Extend partition framing to structure where indicated and to ceiling in other locations maximum spacing.
  - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
  - 3. 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.

### 3.3. 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. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### 3.4. BOARD INSTALLATION

- A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
  - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

- F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108/A118/A136.1 and manufacturer's instructions.

### 3.5. 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.

### 3.6. JOINT TREATMENT

- A. 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.
  - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  - 5. Level 0: Temporary partitions.
- B. 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.
  - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
- C. 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.

### 3.7. TOLERANCES

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

**END OF SECTION 09 2116**



**SECTION 09 3000 - TILING****PART 1 GENERAL****1.1. SECTION INCLUDES**

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

**1.2. RELATED REQUIREMENTS**

- A. Section 07 1400 - Fluid-Applied Waterproofing.

**1.3. REFERENCE STANDARDS**

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
- C. 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; 1999 (Reaffirmed 2010).
- D. 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 2010).
- 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; 1999 (Reaffirmed 2010).
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).

- 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 2010).
- N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
- 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 A137.1 - American National Standard Specifications for Ceramic Tile; 2012.
- T. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2017.

#### 1.4. SUBMITTALS

- A. See Section 01 3000 - 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, control and expansion joints, thresholds, ceramic accessories, and setting details.
- 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 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 1 percent of each size, color, and surface finish combination, but not less than \_\_\_\_ of each type.

#### 1.5. DELIVERY, STORAGE, AND HANDLING

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

#### 1.6. FIELD CONDITIONS

### PART 2 PRODUCTS

#### 2.1. TILE

- A. Manufacturers: All products by the same manufacturer.

- B. Glazed Wall Tile, Type \_\_: ANSI A137.1, standard grade.
- C. Porcelain Tile, Type \_\_\_\_: ANSI A137.1, standard grade.

## 2.2. TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
  - 1. Applications:
    - a. Open edges of wall tile.
    - b. Open edges of floor tile.
    - c. Wall corners, outside and inside.
    - d. Transition between floor finishes of different heights.
  - 2. Manufacturers:
    - a. Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle).

## 2.3. SETTING MATERIALS

- A. Manufacturers:
  - 1. LATICRETE International, Inc; \_\_\_\_: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 2. TEC, an H.B. Fuller Construction Products Brand; : [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  - 3. Mapei, Inc.; .
- B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
  - 1. Products:
    - a. TEC, an H.B. Fuller Construction Products Brand; TEC Ultimate Large Tile Mortar: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - b. Mapei, Inc.; \*\*\*\* PRODUCT NAME \*\*\*\*.

## 2.4. GROUTS

- A. Manufacturers:
  - 1. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 2. TEC, an H.B. Fuller Construction Products Brand; : [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  - 3. Mapei, Inc..
- 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. Products:

- a. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout:  
[www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- b. TEC, an H.B. Fuller Construction Products Brand; TEC AccuColor Plus Grout:  
[www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
- c. Mapei, Inc.; Flexcolor CQ.

## 2.5. ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
  1. Thickness: 20 mils, maximum.
  2. Crack Resistance: No failure at 1/16 inch gap, minimum.
  3. Products:
    - a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane:  
[www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- B. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
  1. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber or Acrylic.
    - b. Thickness: 25 mils, minimum, dry film thickness.
    - c. Products:
      - 1) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
      - 2) LATICRETE International, Inc; LATICRETE HYDRO BAN: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- 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.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that sub-floor 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. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

### 3.2. 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.

### 3.3. INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, 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.

### 3.4. INSTALLATION - WALL TILE

- A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
- C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

### 3.5. CLEANING

- A. Clean tile and grout surfaces.

3.6. PROTECTION

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

**END OF SECTION 09 3000**

**SECTION 09 5100 - ACOUSTICAL CEILINGS****PART 1 GENERAL****1.1. SECTION INCLUDES**

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

**1.2. REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- 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; 2017.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
- F. UL (FRD) - Fire Resistance Directory; Current Edition.

**1.3. ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, mechanical and electrical items installed in the ceiling, and sprinklers installed in the ceiling.
- C. Product Data: Provide data on suspension system components.
- D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 6 inches long, of suspension system main runner.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

### 1.5. QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

### 1.6. 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

### 2.1. MANUFACTURERS

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc; \_\_\_\_: [www.armstrong.com](http://www.armstrong.com).
  - 2. Acoustic Ceiling Products, Inc; \_\_\_\_: [www.acpideas.com/#sle](http://www.acpideas.com/#sle).
  - 3. CertainTeed Corporation; \_\_\_\_: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 4. USG; \_\_\_\_: [www.usg.com/#sle](http://www.usg.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
  - 1. Same as for acoustical units.
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

### 2.2. ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer
- C. Acoustical Tile Type ACT-1 (Typical): Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
  - 1. Size: 24 by 24 inches.
  - 2. Thickness: 3/4 inches.
  - 3. Light Reflectance: 0.86 percent, determined in accordance with ASTM E1264.
  - 4. NRC Range: Not less than 0.70, determined in accordance with ASTM E1264.
  - 5. Articulation Class (AC): 170, determined in accordance with ASTM E1264.
  - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
  - 7. Joint: Reveal sized to fit flange of exposed suspension-system members..
  - 8. Edge: Beveled tegular.



9. Surface Color: White.
10. Surface Pattern: Perforated, regularly spaced large holes.
11. Products:
  - a. Basis-of-Design Product: Armstrong World Industries, Inc. Cirrus #589.
  - b. Or comparable from listed manufacturers meeting Basis of Design specifications.
  - c. Substitutions: See Section 01 6000 - Product Requirements.

## 2.3. SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Exposed Steel Suspension System: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.
  1. Profile: Tee; 9/16 inch wide face.
  2. Construction: Double web.
  3. Finish: White painted.
  4. Products:
    - a. Armstrong World Industries, Inc.; Suprafine XL.
    - b. Or comparable from listed manufacturers.
    - c. Substitutions: See Section 01 6000 - Product Requirements.

## 2.4. ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
  1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

## PART 3 EXECUTION

### 3.1. EXAMINATION

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

### 3.2. 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. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. 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.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
  - 2. Overlap and rivet corners.
- K. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

### 3.3. 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. Lay directional patterned units with pattern parallel to longest room axis.
- D. Fit border trim neatly against abutting surfaces.
- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.

### 3.4. 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 09 5100**

**SECTION 09 6500 - RESILIENT FLOORING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Resilient base.
- B. Installation accessories.

**1.2. REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - 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. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Verification Samples: Submit two samples, 2 by 4 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

**1.4. QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

**1.5. 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.

## 1.6. FIELD CONDITIONS

## PART 2 PRODUCTS

### 2.1. RESILIENT BASE

- A. Resilient Base - Type RB-1: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
1. Manufacturers:
    - a. Burke Flooring; Commercial Wall Base - TS: [www.burkeflooring.com/#sle](http://www.burkeflooring.com/#sle).
    - b. Johnsonite, a Tarkett Company; Baseworks Thermoset Rubber, Type TS: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - c. Roppe Corp; Pinnacle Rubber Wall Base, Type TS: [www.roppe.com/#sle](http://www.roppe.com/#sle).
  2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
  3. Height: 4 inch.
  4. Thickness: 0.125 inch.
  5. Finish: Satin.
  6. Style: Coved, with toe.
  7. Length: Roll.
  8. Color: To be selected by Architect from manufacturer's full range of colors, all grades and categories.
  9. Accessories: Premolded external corners and internal corners.

### 2.2. ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Same material as flooring.
1. Manufacturers:
    - a. Burke Flooring; Mercer Vinyl Mouldings: [www.burkeflooring.com/#sle](http://www.burkeflooring.com/#sle).
    - b. Tarkett; Wheeled Traffic Transitions, Adaptors and Reducers: [https://commercial.tarkett.com/en\\_US/](https://commercial.tarkett.com/en_US/).
    - c. Roppe; Reducers, Transitions and Adaptors: <https://roppe.com/rubber-accessories/>.

### PART 3 EXECUTION

#### 3.1. 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.

#### 3.2. PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is fully cured.
- C. Clean substrate.

#### 3.3. Installation - General

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
  - 1. Resilient Strips: Attach to substrate using adhesive.

#### 3.4. 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.
- D. Scribe and fit to door frames and other interruptions.

#### 3.5. CLEANING

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

#### 3.6. PROTECTION

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

**END OF SECTION 09 6500**



**SECTION 09 6700 - FLUID-APPLIED FLOORING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Fluid-applied flooring and base.

**1.2. REFERENCE STANDARDS**

- A. ANSI/ESD STM7.1 - Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items - Floor Materials - Resistive Characterization of Materials; 2013.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- D. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 3 by 3 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

**1.4. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
  - 1. Approved by manufacturer.

**1.5. MOCK-UP**

- A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
  - 1. Number of Mock-Ups to be Prepared: One.
  - 2. Use same materials and methods for use in the work.



3. Locate where directed.
  4. Minimum Size: 48 inches by 48 inches.
- B. Obtain approval of mock-up by Architect before proceeding with work.
- C. Approved mock-up may remain as part of the Work.

#### 1.6. DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

#### 1.7. FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Fluid-Applied Flooring:
1. Dur-A-Flex, <https://www.dur-a-flex.com/>.
  2. Sherwin-Williams Company: General Polymers Brand; : [www.generalpolymers.com/#sle](http://www.generalpolymers.com/#sle).
  3. Sika Corporation; : [www.sikafloorusa.com/#sle](http://www.sikafloorusa.com/#sle).
  4. Stonhard; <https://www.stonhard.com/>.

#### 2.2. Fluid-Applied Flooring SYSTEMS

- A. Fluid-Applied Flooring Type EPX-1: Flexible epoxy membrane, polyaspartic aliphatic polyurea body coat(s), with broadcast aggregate.
1. Aggregate: Micro Chips.
  2. Top Coat: Epoxy.
  3. System Thickness: 3/16 inch, nominal, when dry.
  4. Texture: Orange peel.
  5. Sheen: Satin.
  6. Color: Custom, as selected by Architect from full range of colors.
  7. Basis of Design Product: DurAFlex.
  8. Products:
    - a. Basis of Design Hybri-Flex EC Self Leveling Epoxy Resin Broadcast with Micro Chips.

### 2.3. ACCESSORIES

- A. Base Caps: Extruded anodized aluminum with projecting base of 1/8 inch; clear anodized or stainless steel color.
- B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- C. Primer: Type recommended by fluid-applied flooring manufacturer.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- 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 flooring.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
  - 1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours, tested according to ASTM F1869.
  - 2. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.
- E. Verify that required floor-mounted utilities are in correct location.

### 3.2. PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Prepare concrete surfaces according to ICRI 310.2R, .
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.
- E. Apply primer to surfaces required by flooring manufacturer.

### 3.3. INSTALLATION - Accessories

- A. Install terminating cap strip at top of base; attach securely to wall substrate.

### 3.4. INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness indicated.

- C. Finish to smooth level surface.
- D. Install flooring in recessed type floor access covers.
- E. Cove at vertical surfaces.

3.5. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Test installed floor surface in accordance with ANSI/ESD STM7.1 .

3.6. PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

**END OF SECTION 09 6700**

**SECTION 09 6813 - TILE CARPETING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Carpet tile, fully adhered.

**1.2. REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.
- C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - 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. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and \_\_\_\_\_.
- E. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

**1.4. QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

**1.5. FIELD CONDITIONS**

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

## PART 2 PRODUCTS

### 2.1. MANUFACTURERS

#### A. Tile Carpeting:

1. Interface, Inc: [www.interfaceinc.com/#sle](http://www.interfaceinc.com/#sle).
2. Lees Carpets; : [www.leescarpets.com/#sle](http://www.leescarpets.com/#sle).
3. Tandus; : [www.tandus.com/#sle](http://www.tandus.com/#sle).
4. Mannington Mills; [www.manningtoncommercial.com](http://www.manningtoncommercial.com).
5. J&J Invision; [www.jj-invision.com](http://www.jj-invision.com).

### 2.2. MATERIALS

#### A. Tile Carpeting, Type CPT-1: Tufted, manufactured in one color dye lot.

1. Product: Manufacturer's material allowance of \$28 per square yard.
2. Tile Size: TBD.
3. Color: TBD.
4. Pattern: TBD.
5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
6. Yarn Fiber: Solution Dyed.
7. Installation Method: TBD.

#### B. Tile Carpeting, Type [CPT-2]: Tufted, manufactured in one color dye lot.

1. Product: Manufacturer's material allowance of \$45 per square yard.
2. Tile Size: TBD.
3. Color: TBD.
4. Pattern: TBD.
5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
6. Yarn Fiber: Solution Dyed.
7. Installation Method: TBD.

### 2.3. ACCESSORIES

#### A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

#### B. Edge Strips: Rubber, color as selected by Architect.

#### C. Adhesives:

1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
  - 1. Test in accordance with ASTM F710.
  - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

#### 3.2. PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

#### 3.3. INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor 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 square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

#### 3.4. CLEANING

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

**END OF SECTION 09 6813**



**SECTION 09 9123 - INTERIOR PAINTING****PART 1 GENERAL****1.1. 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.

**1.2. DEFINITIONS**

- A. Conform to ASTM D16 for interpretation of terms used in this section.
- B. Gloss Ratings: ASTM D523; on 60 and 85 degree gloss meters:
  - 1. Flat (Gloss Level 1): maximum 5 units (60 degree), maximum 10 units (85 degree)
  - 2. Velvet (Gloss Level 2): maximum 10 (60 degree), 10 to 35 units (85 degree)
  - 3. Eggshell (Gloss Level 3): 10 to 25 (60 degree), 10 to 35 units (85 degree)
  - 4. Satin (Gloss Level 4): 20 to 35 units (60 degree), minimum 35 units (85 degree)
  - 5. Semi-Gloss (Gloss Level 5): 35 to 70 units (60 degree)
  - 6. Gloss (Gloss Level 6): 70 to 85 units (60 degree)
  - 7. High-Gloss (Gloss Level 7): more than 85 units (60 degree)

**1.3. REFERENCE STANDARDS**

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; current edition, [www.paintinfo.com](http://www.paintinfo.com).

**1.4. SUBMITTALS**

- A. 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. Manufacturer's installation instructions.
- B. Samples: Submit three "draw down" samples on rigid backing, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Label each coat of each sample.
  - 2. Label each sample for location and application area.
- C. Manufacturer's Instructions: Indicate special surface preparation procedures.
- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions,



touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra 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.

#### 1.5. QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.
- B. Basis of Design: Specifications are based on paint types and systems by specified basis of design manufacturer. Paint types and systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in formulation, compatibility, and performance are minor, and do not detract substantially from the indicated design intent.
  - 1. Comply with or exceed the MPI Environmental Performance Rating.

#### 1.6. 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. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### 1.7. FIELD CONDITIONS

- A. 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

### 2.1. MANUFACTURERS

#### A. Paints:

1. Basis of Design Manufacturer: Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
2. Benjamin Moore & Co: [www.benjaminmoore.com](http://www.benjaminmoore.com).
3. PPG Paints: [www.ppgpaints.com](http://www.ppgpaints.com).

#### B. Primers/Sealers: Same manufacturer as top coats.

#### C. Accessory Products: Secondary products not specified by names and required in the work, such as oils, thinners, patching compounds, putty, and sealers shall be the best grade or first-line products from the approved manufacturers.

#### D. Substitutions: See Section 01 6000 - Product Requirements.

### 2.2. 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.

#### B. Primers: As follow unless other primer is required or recommended by manufacturer top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

#### C. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
  - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

#### D. Chemical Content: The following compounds are prohibited:

1. Intentionally added methylene chloride or perchloroethylene.
2. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

3. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-nu-butyl phthalate, di-n-octyl phthalate, 1,2-diclorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formadehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Flammability: Comply with applicable code for surface burning characteristics.

F. Colors: As indicated on drawings.

1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

### 2.3. PAINT SYSTEMS - INTERIOR

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and concrete masonry units:

1. Two top coats and one coat primer.
2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
3. Primer: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, No. B28 Series.

B. Metal Door and Door Frames: For surfaces subject to frequent contact by occupants, including metals:

1. Medium duty applications include doors and door frames.
2. Two top coats and one coat primer.
3. Top Coat(s): High Performance Architectural Interior Latex; MPI #139, 140, or 141.
  - a. Basis of Design Product:
    - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
    - 2) Substitutions: Section 01 6000 - Product Requirements.
4. Primer: As specified under "PRIMERS" below.

### 2.4. PRIMERS/SEALERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Block Filler:
  - a. Basis of Design Products:
    - 1) Sherwin Williams, PrepRite Block Filler.
2. Interior Latex Primer Sealer; MPI #50.
  - a. Basis of Design Products:
    - 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28 Series.
3. Interior Rust-Inhibitive Water Based Metal Primer; MPI #107.

- a. Basis of Design Products:
  - 1) Sherwin-Williams Pro Industrial Pro-Cryl Universal Metal Primer, B66W00310.
- 4. Bonding Primer, Water Based; MPI #17, #39.
  - a. Basis of Design Products:
    - 1) Sherwin-Williams Multi-Purpose Latex Primer/Sealer, B51W00450.

## 2.5. 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

### 3.1. EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. 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.
  - 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
  - 3. Concrete Floors and Traffic Surfaces: 8 percent.

### 3.2. 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 mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Galvanized Surfaces:

1. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:

1. Solvent clean according to SSPC-SP1.
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.

J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3. APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5. CLEANING

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

3.6. PROTECTION

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

### 3.7. INTERIOR PAINTING SCHEDULE

#### A. Gypsum Board Substrate, Latex System at Walls and Ceilings, Interior:

1. Primer: Basis of Design: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer; MPI #50.
2. Intermediate Coat: matching topcoat; MPI #43.
3. Top Coat: Basis of Design: Sherwin-Williams ProMar 200 Low VOC Latex Acrylic, Semi-Gloss; MPI #43.
  - a. Location: Restroom Ceilings, gyp walls with any plumbing fixtures, storage areas.

#### B. Gypsum Board Substrate, Latex System at Walls, Interior.

1. Primer: Basis of Design: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer; MPI #50.
2. Intermediate Coat: matching topcoat; MPI #52.
3. Top Coat: Basis of Design: Sherwin-Williams ProMar 200 Low VOC Latex Acrylic, Eg-shel; MPI #52.

#### C. Concrete Masonry Units, Latex System at Walls, Interior:

1. Block Filler: Basis of Design: Sherwin Williams, PrepRite Block Filler.
2. Primer: Basis of Design: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer; MPI #50.
3. Intermediate Coat: matching topcoat; MPI #43.
4. Top Coat: Basis of Design: Sherwin-Williams ProMar 200 Low VOC Latex Acrylic, Semi-Gloss; MPI #43.

#### D. Aluminum Substrates, Interior:

1. Primer: Basis of Design: Sherwin-Williams Pro Industrial Pro-Cryl Univeral Acrylic Primer, No. B66W00310 Series; MPI #107.
2. Intermediate Coat: matching topcoat; MPI #141.
3. Top Coat: Basis of Design: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss; MPI #141.

#### E. Steel Substrates, Interior:

1. Primer: Basis of Design: Sherwin-Williams Pro Industrial Pro-Cryl Univeral Acrylic Primer, No. B66W00310 Series; MPI #107.
2. Intermediate Coat: matching topcoat; MPI #154.
3. Top Coat: Basis of Design: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss; MPI #141.

### END OF SECTION

**SECTION 10 1401 - CODE-REQUIRED SIGNAGE****PART 1 GENERAL****1.1. SCOPE**

- A. Signage listed in this section to be furnished and installed by Owner, unless noted otherwise.

**1.2. SECTION INCLUDES**

- A. Room identification signs.
- B. Directional / informational signs.
- C. Directional signs to accessible building elements.
- D. Non-illuminated exit door signs.
- E. Accessible toilet signs.
- F. Stair floor landing signs.
- G. Area of refuge signs.
- H. Exterior area of rescue assistance signs.
- I. Two-way communication instructional signs.
- J. Maximum occupancy signs.
- K. Fire and smoke partition identification.
- L. Fire and smoke damper access identification.
- M. Emergency evacuation maps.

**1.3. SECTION EXCLUDES**

- A. Illuminated exit signs.
- B. Site and parking signs.
- C. Identification for plumbing piping and equipment.
- D. Identification for electrical systems.
- E. Signage provided by elevator manufacturer.

**1.4. 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.

- D. IAC - Illinois Accessibility Code; 1997.

#### 1.5. SUBMITTALS

- A. See Section 01 3000 - 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 at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  - 3. Submit for approval by Owner prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

#### 1.6. QUALITY ASSURANCE

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

#### 1.7. 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.
- C. Store tape adhesive at normal room temperature.

#### 1.8. FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.



## PART 2 PRODUCTS

### 2.1. SIGNAGE COMPONENTS

- A. See referenced standards for additional requirements for each component.
- B. Visual Characters:
  - 1. Character Height: 1 inch.
  - 2. Mounting Height: Baseline of lowest characters to be 40 inches minimum above the floor.
- C. Raised (Tactile) Characters:
  - 1. Comply with all requirements for Visual characters.
  - 2. Characters to be raised 1/32 inch minimum above their background.
  - 3. Mounting Height: Baseline of lowest characters to be 40 inches minimum above the floor. Baseline of highest characters to be 60 inches maximum above the floor.
  - 4. Mounting Location:
    - a. At single doors, mount on wall adjacent to latch side of door.
    - b. At double doors with an inactive leaf, mount on inactive leaf.
    - c. At double doors with two active leaves, mount on wall to the right of the right-hand door.
    - d. Where there is no wall space at the positions listed above, mount on the nearest adjacent wall.
    - e. Locate sign to provide an 18 inch x 18 inch minium clear floor space centered on the sign and beyond the arc of any door swing between the closed position and 45 degree open position.
- D. Braille Characters:
  - 1. Locate below corresponding text.
  - 2. Mounting Height: Baseline of lowest characters to be 40 inches minimum above the floor. Baseline of highest characters to be 60 inches maximum above the floor.
- E. Pictograms:
  - 1. Height of pictogram field to be 6 inches minimum.
  - 2. Characters or braille shall not be located in the pictogram field.
  - 3. Provide equivalent text description in Raised characters and Braille directly below the pictogram.
- F. International Symbol of Accessibility:
- G. 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: As selected by Architect from manufacturer's full range.
  - 4. Character/Pictogram Color: Contrasting color.

## 2.2. SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards, ICC A117.1, IAC, and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room Identification Signs: Provide a sign for every doorway, whether it has a door or not, including corridors, lobbies, and similar open areas.
  - 1. Sign Type: Flat signs with engraved panel media as specified.
  - 2. Provide Raised characters and Grade II Braille.
  - 3. Mounting Height: (IAC) Centerline of sign to be 60 inches above the floor.
- C. Toilet and Bathing Room Identification Signs:
  - 1. Sign Type: Flat signs with engraved panel media as specified.
  - 2. Identify room as "MEN", "WOMEN", "FAMILY", or "UNISEX" as designated on drawings.
  - 3. Provide Raised characters and Grade II Braille and Pictograms.
  - 4. Provide international symbol of accessibility.
  - 5. Mounting Height: (IAC) Centerline of sign to be 60 inches above the floor.
  - 6. Non-Accessible Toilet and Bathing Rooms:
    - a. Omit international symbol of accessibility on identification sign.
    - b. Provide Accessible Directional Sign as described below.
- D. Directional Signs to Accessible Building Elements:
  - 1. Indicates route to nearest like accessible element.
  - 2. Provide Visual characters.
  - 3. Provide international symbol of accessibility.
  - 4. Provide at the following locations:
    - a. Inaccessible building entrances.
    - b. Inaccessible toilet and bathing rooms.
    - c. Elevator landings indicating nearest accessible means of egress.
    - d. Each separate-sex toilet and bathing room indicating location of nearest family or assisted-use toilet or bathing room.
    - e. Exits and exit stairways serving a required accessible space but not providing an approved accessible means of egress.
- E. Directional and Informational Signs (Not related to accessible or emergency signage):
  - 1. Signs that provide direction to, or information about, permanent interior spaces (excluding building directories, personnel names, occupant names or logos, menus, and temporary signs).
  - 2. Provide Visual characters.
- F. Non-Illuminated Exit Signs:

1. Provide adjacent to each door to an area of refuge, exterior area of rescue assistance, exit stairway, exit ramp, exit passageway, and exit discharge (excluding exterior doors clearly identifiable as exits).
  2. Provide Raised characters and Grade II Braille stating "EXIT".
- G. Stairway Signs: Signs required at each stairway connecting more than three stories.
1. Provide stairway identification sign at each floor landing to include the following:
    - a. Floor level.
    - b. Terminus of top and bottom of stairway.
    - c. Identification of stair.
    - d. Story of and the direction to the exit discharge.
    - e. Availability of roof access from the stairway for the fire department.
  2. Size: 12 inch x 18inch minimum.
  3. Provide Visual characters.
  4. Also, provide floor-level sign at each floor-level landing, adjacent to each door leading from the stairway, identifying the floor level using Raised characters and Grade II Braille.
- H. Elevator Signs: Signs required at elevators that are not part of an accessible means of egress.
1. Provide approved pictorial sign adjacent to each elevator call station on all floors stating the following with Visual characters:
    - a. "IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS."
- I. Accessible Entrance Signs: Signs required when not all building entrances are accessible.
1. Provide international symbol of accessibility at accessible entrances.
- J. Maximum Occupant Load Signs: Signs required at every room that is an Assembly occupancy.
1. Provide Visual characters indicating the occupant load of the room or space.
  2. Mounting Location: Post in a conspicuous place, near the main exit from the room or space.
- K. Area of Refuge Signs:
1. Provide lighted sign, on or above each door providing access to an area of refuge, stating "AREA OF REFUGE"
  2. At area of refuge, provide instructional signage with Visual characters to include the following:
    - a. Persons able to use the exit stairway do so as soon as possible, unless they are assisting others.
    - b. Information on planned availability of assistance in the use of stairs or supervised operation of elevators and how to summon such assistance.
    - c. Directions for use of the two-way communication system where provided. See Two-Way Communication System Directions below.
- L. Exterior Area of Rescue Assistance Signs:
1. Provide lighted sign, on or above each door providing access to an exterior area of rescue assistance, stating "EXTERIOR AREA FOR ASSISTED RESCUE".

2. At exterior area for assisted rescue, provide instructional signage with Visual characters to include the following:
    - a. Persons able to use the exit stairway do so as soon as possible, unless they are assisting others.
    - b. Information on planned availability of assistance in the use of stairs or supervised operation of elevators and how to summon such assistance.
    - c. Directions for use of the two-way communication system where provided. See Two-Way Communication System Directions below.
  - M. Two-Way Communication System Direction Signs:
    1. Provide Visual characters with instructions for summoning assistance via the two-way communication system and written identification of the location.
    2. Mount adjacent to two-way communication system.
  - N. Fire and Smoke Partition Identification:
    1. Contractor to provide.
    2. Provide permanent identification, via signs or stenciling, on all fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions or any other wall required to have protected openings or penetrations. Such identification shall:
      - a. Be located in accessible concealed floor, floor-ceiling, or attic spaces.
      - b. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition.
      - c. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in a contrasting color incorporating the suggested wording "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS".
  - O. Fire and Smoke Damper Access Identification:
    1. Contractor to provide.
    2. Provide permanent identifications on exterior of all access points to fire and smoke dampers.
    3. Label to have letters not less than 1/2 inch in height stating "FIRE/SMOKE DAMPER", "SMOKE DAMPER", or "FIRE DAMPER" as applicable.
  - P. Rooms containing controls for A/C systems, sprinkler risers and valves, or other fire detection, suppression elements shall be identified for use by the Fire Department.
  - Q. Emergency Evacuation Maps:
- 2.3. SIGN TYPES
- A. Flat Signs: Signage media without frame.
    1. Edges: Square.
    2. Corners: Square.
    3. Wall Mounting of One-Sided Signs: Tape adhesive.

2.4. RAISED CHARACTER SIGNAGE MEDIA

- A. Raised characters to be raised 1/32 inch minimum above their background.
- B. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:

**END OF SECTION 10 1401**

**SECTION 10 2113.13 - METAL TOILET COMPARTMENTS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Metal toilet compartments.
- B. Urinal and Vestibule screens.

**1.2. RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

**1.3. REFERENCE STANDARDS**

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit two samples of partition panels, 3 by 3 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Metal Toilet Compartments:
  - 1. All American Metal Corp - AAMCO; : [www.allamericanmetal.com/#sle](http://www.allamericanmetal.com/#sle).
  - 2. General Partitions Mfg. Corp; : [www.generalpartitions.com/#sle](http://www.generalpartitions.com/#sle).
  - 3. Bradley Corporation; <https://www.bradleycorp.com/commercial>.
  - 4. Substitutions: Section 01 6000 - Product Requirements.

**2.2. MATERIALS**

- A. Stainless Steel Sheet: ASTM A666, Type 304.

**2.3. COMPONENTS**

- A. Toilet Compartments: Stainless steel, floor-mounted headrail-braced.

- B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.
  - 1. Panel Faces: 22 gage, 0.0299 inch.
  - 2. Door Faces: 22 gage, 0.0299 inch.
  - 3. Pilaster Faces: 22 gage, 0.0299 inch.
- C. Door and Panel Dimensions:
  - 1. Thickness: 1 inch.
  - 2. Door Width: 24 inch.
  - 3. Door Width for Handicapped Use: 36 inch, out-swinging.
  - 4. Height: 58 inch.
- D. Pilasters: 1-1/4 inch thick, of sizes required to suit compartment width and spacing.
- E. Urinal Screen: Stainless steel, wall mounted with full height flange.
  - 1. Thickness: 1 inch.
  - 2. Panel Size: 18 inches by 48 inches.

#### 2.4. ACCESSORIES

- A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.
- B. Head Rails: Hollow stainless steel tube, 1 by 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.
- C. Brackets: Satin stainless steel, full height of panels.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
  - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- E. Hardware: Satin stainless steel:
  - 1. Pivot hinges, continuous, gravity type, adjustable for door close positioning.
  - 2. Thumb turn or sliding door latch with exterior emergency access feature.
  - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
  - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
  - 5. Provide door pull for outswinging doors.

#### 2.5. FINISHING

- A. Stainless Steel Compartments: No. 4 finish.
  - 1. Texture: Diamond.

**PART 3 EXECUTION****3.1. EXAMINATION**

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

**3.2. INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 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.
- E. Field touch-up of scratches or damaged enamel finish will not be permitted. Replace damaged or scratched materials with new materials.

**3.3. TOLERANCES**

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

**3.4. 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**



**SECTION 10 2600 - WALL AND DOOR PROTECTION****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Protective wall covering.
- B. Door and frame protection.

**1.2. RELATED REQUIREMENTS**

- A. Section 08 7100 - Door Hardware: Standard protection plates and trim.
- B. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

**1.3. REFERENCE STANDARDS**

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2014.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
  - 1. Submit two full-size samples of door edge protectors.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Stock Materials: One package(s) of minimum 96 inches long unit of each kind of covers for corner guards, bumper rails, and protective corridor handrails.

**1.5. DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.

- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in conformance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in conformance with manufacturer's instructions.

#### 1.6. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer and installer warranty for metal crash rails.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Protective Wall Covering:
- B. Plastic Door, Frame, and Knob/Lever Protection:
- C. Metal Door, Frame, and Knob/Lever Protection:

#### 2.2. PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for conformance to applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance conforming to applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

#### 2.3. PRODUCT TYPES

#### 2.4. FABRICATION

- A. Fabricate components with tight joints, corners and seams.

#### 2.5. SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
- C. Start of installation constitutes acceptance of project conditions.

3.2. INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

3.3. TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.4. CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

**END OF SECTION 10 2600**

**SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Electric hand/hair dryers.
- D. Diaper changing stations.
- E. Utility room accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 10 2113.19 - Plastic Toilet Compartments.
- B. Section 22 4000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

**1.3. REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated.
  - 2. Identify products using designations indicated.

#### D. CLOSEOUT SUBMITTALS

1. Maintenance Data: For toilet, shower, and bath accessories to include in maintenance manuals.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

##### A. Commercial Toilet, Shower, and Bath Accessories:

1. Subject to compliance with requirements, provide product indicated as Basis of Design or comparable product by one of the following:
  - a. American Specialties, Inc: [www.americanspecialties.com](http://www.americanspecialties.com).
  - b. Bradley Corporation: [www.bradleycorp.com](http://www.bradleycorp.com).
  - c. Georgia-Pacific Professional: [www.blue-connect.com](http://www.blue-connect.com).
  - d. Substitutions: Section 01 6000 - Product Requirements.

##### B. Under-Lavatory Pipe Supply Covers:

1. Plumberex Specialty Products, Inc; \_\_\_\_: [www.plumberex.com/#sle](http://www.plumberex.com/#sle).

##### C. Electric Hand/Hair Dryers:

1. Excel Dryer; Xlerator Hand Dryer: [www.exceldryer.com/#sle](http://www.exceldryer.com/#sle), or approved equal.
2. Substitutions: Section 01 6000 - Product Requirements.

##### D. Diaper Changing Stations:

1. Subject to compliance with requirements, provide product indicated as Basis of Design or comparable product by one of the following:
  - a. American Specialties, Inc: [www.americanspecialties.com](http://www.americanspecialties.com).
  - b. Bradley Corporation: [www.bradleycorp.com](http://www.bradleycorp.com).
  - c. Koala Kare Products: [www.koalabear.com](http://www.koalabear.com).
  - d. Substitutions: 01 6000 - Product Requirements.

#### 2.2. MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

### 2.3. FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

### 2.4. Commercial Toilet Accessories

- A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
  - 1. Attached Purse Shelf: 0.03 inch satin finished stainless steel, with rolled or formed edge at front.
- B. [T4] (OFCI) Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock and drip tray.
  - 1. Minimum Capacity: 48 ounces.
- C. [T5] Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
  - 1. Size: 24" x 36".
  - 2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
- D. Grab Bars, Typical: Stainless steel, nonslip grasping surface finish.
  - 1. [T7-T9] Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
    - d. Length and Configuration: As indicated on drawings.
- E. [T12] Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

### 2.5. UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. [T20] Under-Lavatory Pipe and Supply Covers:
  - 1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
  - 2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
  - 3. Construction: 1/8 inch flexible PVC.
    - a. Surface Burning Characteristics: Self extinguished 0 sec (ATB), 0 mm (AEB) when tested in accordance with ASTM-D-635.
    - b. Comply with ICC A117.1.
    - c. Microbial and Fungal Resistance: Comply with ASTM G21.
  - 4. Color: White.
  - 5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.

- 6. Products:
  - a. Basis of Design: Truebro; Lav Guard 2.
  - b. Substitutions: Section 01 6000 - Product Requirements.

## 2.6. Electric Hand/Hair Dryers

- A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
  - 1. Operation: Automatic, sensor-operated on and off.
  - 2. Mounting: Surface mounted.
  - 3. Total Wattage: 1500 W, maximum.
  - 4. Voltage: 120V.

## 2.7. Diaper Changing Stations

- A. [T21] Horizontal Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
  - 1. Material: Polyethylene.
  - 2. Mounting: Surface. Projects not more than 4 inches from wall when closed.
  - 3. Color: Gray.
  - 4. Minimum Rated Load: 50 pounds.

## 2.8. Utility Room Accessories

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  - 1. Drying rod: Stainless steel, 1/4 inch diameter.
  - 2. Hooks: 5, 0.06 inch stainless steel rag hooks at shelf front.
  - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
  - 4. Length: Manufacturer's standard length for number of holders/hooks.

# PART 3 EXECUTION

## 3.1. EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

## 3.2. PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3. INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Wall backing: Install concealed wall backing as required to support each item.
- D. Mounting Heights: As indicated on drawings.

3.4. PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION 10 2800**



**SECTION 12 3600 - COUNTERTOPS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Countertops for manufactured casework.
- B. Wall-hung counters and vanity tops.

**1.2. RELATED REQUIREMENTS**

- A. Section 06 4100 - Architectural Wood Casework.
- B. Section 22 4000 - Plumbing Fixtures: Sinks.

**1.3. REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- F. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - 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. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

### 1.5. QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Quality Certification:
  - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by certification program.
  - 3. Provide designated labels on installed products as required by certification program.
  - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

### 1.6. DELIVERY, STORAGE, AND HANDLING

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

### 1.7. FIELD CONDITIONS

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

## PART 2 PRODUCTS

### 2.1. COUNTERTOPS

- A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
  - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
    - a. Manufacturers:
      - 1) Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
      - 2) Panolam Industries International, Inc; Nevamar Standard HPL: [www.panolam.com/#sle](http://www.panolam.com/#sle).
      - 3) Panolam Industries International, Inc; Pionite Standard HPL: [www.panolam.com/#sle](http://www.panolam.com/#sle).
      - 4) Wilsonart; : [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
    - 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: Matte or suede, gloss rating of 5 to 20.
    - d. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
  - 2. Exposed Edge Treatment: Molded rubber edge with T-spline, sized to completely cover edge of panel.
    - a. Color: As selected by Architect from the manufacturer's full line.

3. Back and End Splashes: Same material, same construction.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Flat Sheet Thickness: 1/2 inch, minimum.
  2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) Dupont: [www.corian.com/#sle](http://www.corian.com/#sle).
      - 2) Formica Corporation; : [www.formica.com/#sle](http://www.formica.com/#sle).
      - 3) Wilsonart; : [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
    - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - c. NSF approved for food contact.
    - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - e. Color and Pattern: As selected by Architect from manufacturer's full line.
  3. Other Components Thickness: 1/2 inch, minimum.
  4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; eased; use marine edge at sinks.
  5. Back and End Splashes: Same sheet material, integral eased edge top; minimum 4 inches high.
  6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

## 2.2. MATERIALS

- A. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- D. Joint Sealant: Mildew-resistant silicone sealant, clear.

## 2.3. 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.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

### PART 3 EXECUTION

#### 3.1. 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.

#### 3.2. 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.

#### 3.3. INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

#### 3.4. 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.

#### 3.5. CLEANING

#### 3.6. 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 12 3600**

**SECTION 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.

**1.3. REFERENCE STANDARDS**

- A. ASME A112.18.1 - Plumbing Supply Fittings; 2018.
- B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2016.
- F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- H. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
- I. FM (AG) - FM Approval Guide; current edition.
- J. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL (DIR) - Online Certifications Directory; Current Edition.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

**PART 2 PRODUCTS****2.1. FIRE PROTECTION SYSTEMS**

- A. Sprinkler Systems: Comply with NFPA 13.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

## 2.2. ABOVE GROUND PIPING

### A. Steel Pipe: Schedule 40, black.

1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
4. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

## 2.3. PIPE SLEEVES

### A. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

## 2.4. ESCUTCHEONS

### A. Material:

1. Metals and Finish: Comply with ASME A112.18.1.

### B. Construction:

1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

## 2.5. PIPE HANGERS AND SUPPORTS

### A. Support sprinkler system pipe and fittings as outlined in NFPA-13 Standards. Include sprinkler head manufacturer's grid support system where flexible heads are utilized.

### B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

## PART 3 EXECUTION

### 3.1. INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.

- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
  - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 2. Place hangers within 12 inches of each horizontal elbow.
  - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- I. Provide sleeves when penetrating footings, floors, walls, partitions, and \_\_\_\_\_. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- J. Escutcheons:
  - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
  - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
  - 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- K. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

**END OF SECTION 21 0500**



**SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.

**1.2. REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
  - 3. Sprinkler Wrenches: For each sprinkler type.

**PART 2 PRODUCTS****2.1. SPRINKLER SYSTEM**

- A. Sprinkler System: Provide coverage for building areas noted.
- B. Occupancy: Light hazard; comply with NFPA 13.
- C. Storage Cabinet for Spare Sprinklers and Tools: Steel, locate adjacent to existing cabinet for each new head type utilized..

**2.2. SPRINKLERS**

- A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate, or concealed/gasketed heads with white cover.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Fusible Link: fusible solder link, or glass bulb temperature rated for specific area hazard.

B. Flexible Drop System: Stainless steel, multiple use, open gate type.

1. Application: Use to properly locate sprinkler heads.
2. Include all supports and bracing.
3. Provide braided type tube as required for the application.

2.3. PIPING SPECIALTIES

A. Test Connections:

1. Inspector's Test Connection for Wet-pipe Systems:
  - a. Route test connection to an open-site drain location, including janitor sinks (with 3" minimum drain), accepting full flow without negative consequences.

PART 3 EXECUTION

3.1. INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Place pipe runs to minimize obstruction to other work.
- D. Place piping in concealed spaces above finished ceilings.
- E. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- F. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- G. Flush entire piping system of foreign matter.
- H. Hydrostatically test entire system.
- I. Require test be witnessed by owner's representative..

3.2. SCHEDULES

A. System Hazard Areas:

1. All renovated areas excluding storage: Light Hazard.
2. Storage: Ordinary Hazard, Group 1.

**END OF SECTION 21 1300**

**SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Applications.
- B. General requirements.
- C. Ball valves.

**1.2. ABBREVIATIONS AND ACRONYMS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. PTFE: Polytetrafluoroethylene.
- E. TFE: Tetrafluoroethylene.

**1.3. REFERENCE STANDARDS**

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- C. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- D. NSF 61 - Drinking Water System Components - Health Effects; 2017.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

**1.5. QUALITY ASSURANCE**

- A. Manufacturer:
  - 1. Obtain valves for each valve type from single manufacturer.

**PART 2 PRODUCTS****2.1. APPLICATIONS**

- A. Provide the following valves for the applications if not indicated on drawings:
  - 1. Shutoff: Ball\_\_\_\_\_.
- B. Domestic, Hot and Cold Water Valves:

1. 2 NPS and Smaller:
  - a. Bronze: Provide with solder-joint or threaded ends.

## 2.2. GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
  1. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
- D. Valve-End Connections:
  1. Threaded End Valves: ASME B1.20.1.
  2. Solder Joint Connections: ASME B16.18.
- E. General ASME Compliance:
- F. Bronze Valves:
  1. Fabricate from dezincification resistant material.
  2. Copper alloys containing more than 15 percent zinc are not permitted.

## 2.3. BRONZE BALL VALVES

- A. Two Piece, Full Port with Bronze Trim:
  1. Comply with MSS SP-110.
  2. SWP Rating: 150 psig.
  3. CWP Rating: 600 psig.
  4. Body: Bronze.
  5. Ends: Threaded.
  6. Seats: PTFE or TFE.

## PART 3 EXECUTION

### 3.1. INSTALLATION

- A. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- B. Adequately support at each valve location to permit proper utilization without excessive movement in the pipe system.

**END OF SECTION 22 0523**

**SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 GENERAL****1.1. REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.

**PART 2 PRODUCTS****2.1. SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
  - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
  - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
  - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
  - 4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- C. Anchors and Fasteners:
  - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  - 4. Hollow Masonry: Use toggle bolts.
  - 5. Hollow Stud Walls: Use toggle bolts.
  - 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  - 7. Sheet Metal: Use sheet metal screws.
  - 8. Wood: Use wood screws.

9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - a. Comply with MFMA-4.
  - b. Channel Material: Use galvanized steel.
  - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

### PART 3 EXECUTION

#### 3.1. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Equipment Support and Attachment:
  1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- G. Secure fasteners according to manufacturer's recommended torque settings.
- H. Remove temporary supports.

### END OF SECTION 22 0529

**SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Pipe markers.

**1.2. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.

**PART 2 PRODUCTS**

**2.1. IDENTIFICATION APPLICATIONS**

- A. Piping: Pipe markers.

**2.2. PIPE MARKERS**

- A. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

**PART 3 EXECUTION**

**3.1. INSTALLATION**

- A. Install plastic pipe markers in accordance with manufacturer's instructions.

**END OF SECTION 22 0553**

**SECTION 22 0719 - PLUMBING PIPING INSULATION****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Piping insulation.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.

**1.3. REFERENCE STANDARDS**

- A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- D. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

**PART 2 PRODUCTS****2.1. REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

**2.2. GLASS FIBER**

- A. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

**2.3. FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
  - 1. Minimum Service Temperature: Minus 40 degrees F.
  - 2. Maximum Service Temperature: 220 degrees F.
  - 3. Connection: Waterproof vapor barrier adhesive.



## PART 3 EXECUTION

### 3.1. INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- E. Glass fiber insulated pipes conveying fluids above ambient temperature:
  - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- F. Inserts and Shields:
  - 1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

### 3.2. SCHEDULES

- A. Plumbing Systems:
  - 1. Domestic Hot Water and Hot Water Circulation pipe systems:
    - a. Glass Fiber Insulation:
      - 1) Pipe Size Range: 1 inch and under.
      - 2) Thickness: \_\_\_\_ inch.
  - 2. Domestic Cold Water:
    - a. Glass Fiber Insulation:
      - 1) Pipe Size Range: All.
      - 2) Thickness: 1 inch. Exception: 1/2 inch thick insulation may be utilized where at individual fixture drops on piping 3/4-inch NPS or smaller.

3. Option: Flexible Elastomeric insulation may be utilized where filling in uninsulated gaps between like insulation materials. Match existing insulation thickness wherever utilized.

**END OF SECTION 22 0719**

**SECTION 22 1005 - PLUMBING PIPING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
  - 1. Sanitary sewer.
  - 2. Domestic water.
  - 3. Flanges, unions, and couplings.
  - 4. Pipe hangers and supports.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.

**1.3. REFERENCE STANDARDS**

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- C. ASME B31.9 - Building Services Piping; 2014.
- D. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2017.
- E. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- F. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
- G. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- H. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
- I. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- J. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
- K. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
- L. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012 (Reapproved 2018).
- M. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- N. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015.

- O. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.
- P. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012).
- Q. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011 (Revised 2012).
- R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
- S. NSF 61 - Drinking Water System Components - Health Effects; 2017.
- T. NSF 372 - Drinking Water System Components - Lead Content; 2016.

#### 1.4. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

#### 1.5. QUALITY ASSURANCE

- A. Perform work in accordance with The Illinois State Plumbing Code as adopted by the City of Peoria..

### PART 2 PRODUCTS

#### 2.1. GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

#### 2.2. SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.
- B. PVC Pipe: ASTM D2665 or ASTM D3034.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

#### 2.3. SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. PVC Pipe: ASTM D2665.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.
3. Utilize cast iron pipe and fittings for waste or vent piping installed within plenum areas (breakroom area). PVC may be utilized from ceiling down in such instances. Review mechanical plans.

#### 2.4. DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
  1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
  2. Joints: ASTM B32, alloy Sn95 solder.

#### 2.5. FLANGES, UNIONS, AND COUPLINGS

- A. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

#### 2.6. PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
  1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
  2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
  3. Trapeze Hangers: Welded steel channel frames attached to structure.
  4. Vertical Pipe Support: Steel riser clamp.

### PART 3 EXECUTION

#### 3.1. PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

#### 3.2. INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- D. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- E. Pipe Hangers and Supports:
  1. Install in accordance with ASME B31.9.

2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

### 3.3. APPLICATION

- A. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

### 3.4. DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect domestic new domestic water system piping as outlined in the Illinois State Plumbing Code.

### 3.5. SCHEDULES

- A. Pipe Hanger Spacing:

#### 1. Metal Piping:

- a. Pipe Size: 1/2 inches to 1-1/4 inches:
  - 1) Maximum Hanger Spacing: 6.5 ft.
  - 2) Hanger Rod Diameter: 3/8 inches.
- b. Pipe Size: 1-1/2 inches to 2 inches:
  - 1) Maximum Hanger Spacing: 10 ft.
  - 2) Hanger Rod Diameter: 3/8 inch.
- c. Pipe Size: 2-1/2 inches to 3 inches:
  - 1) Maximum Hanger Spacing: 10 ft.
  - 2) Hanger Rod Diameter: 1/2 inch.

#### 2. Plastic Piping:

- a. All Sizes:
  - 1) Maximum Hanger Spacing: 6 ft.
  - 2) Hanger Rod Diameter: 3/8 inch.

**END OF SECTION 22 1005**

**SECTION 22 1006 - PLUMBING PIPING SPECIALTIES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Drains.
- B. Cleanouts.
- C. Water hammer arrestors.
- D. Mixing valves.

**1.2. REFERENCE STANDARDS**

- A. NSF 61 - Drinking Water System Components - Health Effects; 2017.
- B. NSF 372 - Drinking Water System Components - Lead Content; 2016.
- C. PDI-WH 201 - Water Hammer Arresters; 2010.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

**PART 2 PRODUCTS****2.1. GENERAL REQUIREMENTS**

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

**2.2. DRAINS**

- A. Refer to plumbing schedules for floor drain descriptions for this project.

**2.3. CLEANOUTS**

- A. Refer to plan schedules for cleanout descriptions for this project.

**2.4. WATER HAMMER ARRESTORS**

- A. Water Hammer Arrestors:
  - 1. Copper construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

**2.5. MIXING VALVES**

- A. Thermostatic Mixing Valves: refer to plan schedule for description.

PART 3 EXECUTION

3.1. INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install floor cleanouts at elevation to accommodate finished floor.
- C. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to each new toilet group on cold water only..

**END OF SECTION 22 1006**



**SECTION 22 4000 - PLUMBING FIXTURES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Electric water coolers.

**1.2. REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. NSF 61 - Drinking Water System Components - Health Effects; 2017.
- C. NSF 372 - Drinking Water System Components - Lead Content; 2016.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

**PART 2 PRODUCTS****2.1. GENERAL REQUIREMENTS**

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

**2.2. REGULATORY REQUIREMENTS**

- A. Comply with applicable codes for installation of plumbing systems.

**2.3. FLUSH VALVE WATER CLOSETS**

- A. Refer to plumbing schedules for water closet and flush valve descriptions for this project.

**2.4. WALL HUNG URINALS**

- A. Refer to plan schedules for wall hung urinal descriptions for this project.

**2.5. LAVATORIES**

- A. Refer to plumbing schedules for lavatories, and lavatory systems to be used for this project.

2.6. SINKS

- A. Refer to plan schedules for sink descriptions for this project.

2.7. ELECTRIC WATER COOLERS

- A. Refer to plan schedules for electric water coolers to be used for this project.

PART 3 EXECUTION

3.1. INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.

3.2. ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

**END OF SECTION 22 4000**

**SECTION 23 0010 - MECHANICAL GENERAL REQUIREMENTS****PART 1 GENERAL****1.1. GENERAL**

- A. All work under this section shall comply with the contract requirements noted on the architectural drawings and/or specifications and shall include all mechanical sections specified herein. All work under this section shall comply with the contract requirements noted on architectural drawings and specifications general requirements.
- B. All cavity spaces between ceiling and structure (plenum spaces) are to be considered return air plenums and all material installed in plenum shall be rated and UL listed for return air plenums.
- C. Mechanical contractor shall schedule start-up session to start HVAC equipment. Schedule one full day of start-up at least two weeks prior to substantial completion.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

**1.3. WORK INCLUDED**

- A. Provide all labor, materials, equipment and tools required for completely finished and operational HVAC and mechanical systems to fulfill the design intent shown on the documents.
- B. Work shall be of the finest quality of construction, materials and workmanship.
- C. Install equipment in accordance with manufacturer recommendations.
- D. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
  - 1. Commissioning agent is engaged to document the completion of the mechanical, life safety, and building control systems for the project. Section defines the role of each member of the commissioning team.
  - 2. Comply with the requirements of Division 1 for the commissioning of the various building systems.
- E. The plans are diagrammatic and generally show the locations of fixtures, equipment, ductwork and piping and shall not be scaled. Provide all offsets, fittings and components required for a complete system even if not explicitly called out on the drawings.

**1.4. COORDINATION AND VERIFICATION**

- A. Refer to the architectural interior details, floor plans, elevations and other contract drawings as well as existing structural, mechanical, fire protection, electrical systems and other existing conditions. Coordinate work with that of the other trades to avoid interference.
- B. All dimensions and existing conditions shall be field verified prior to the commencement of the work.
- C. Contract Documents:
  - 1. General: The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the mechanical work and its interface with other work. Such

establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.

2. When electronic CAD files or building information modeling (BIM) files have been provided to the contractor, the contractor shall only consider the files as design to only show the intent of the design. The contractor shall be responsible for the Coordination drawings based on the design.
3. Work out all "tight" conditions in advance of installation. If necessary, and before work proceeds in those areas, prepare coordination drawings showing all work in congested areas. Provide additional work necessary to overcome congested conditions at no increase in contract sum or schedule.
4. Clearly indicate solutions to space problems. Identification of space problems without solutions is not acceptable. Only areas clearly identified will be reviewed.
5. Acceptance by the Architect/Engineer does not imply acceptance of any deviations from contract documents requirements or acceptance of uncoordinated work. Review is for general conformance to the design concept and general compliance with the information given in the contract documents.
6. Locate equipment requiring periodic servicing so that it is readily accessible. Provide means of service access, following appropriate manufacturer's recommended service clearance space or, as applicable, means of access using duct, wall, or ceiling access doors.
7. Install ductwork and piping to leave sufficient space for AHJ inspection of wall construction.
8. Supplemental Instructions: The exact location for some items in this Specification may not be shown on the Drawings. The location of such items may be established by the Engineer during the progress of the work.
9. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.
10. Discrepancies:
  - a. Examine Drawings and Specifications.
  - b. Report any discrepancies to the Architect and obtain written instructions before proceeding.
  - c. Should there be a conflict within or between the Specifications or Drawings, the more stringent or higher quality requirements shall apply.
  - d. Items called for in either specifications or drawings shall be required as if called for in both.
  - e. Be responsible for providing proper documentation of equipment product data and shop drawings to all entities providing service.

#### 1.5. UTILITY DISRUPTIONS

- A. Existing buildings and their facilities must remain functional while the Work under this Contract is performed. All system shutdowns and outages must be minimized, provided with temporary heating or cooling systems as part of the base bid and coordinated with the Owner.
- B. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption a minimum of two weeks in advance with Owner, authorities having jurisdiction, and all affected trades.
- C. The Contractor shall provide temporary or new services to all existing facilities and utility streams as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

- D. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including any overtime charges for night and weekend work, and temporary systems shall be included in the contract amount.

#### 1.6. CODES, REGULATIONS, FEES, PERMITS

- A. Conform to the codes in force at the time of construction in the jurisdiction of the project.
- B. Call for inspections from the authority having jurisdiction. If discrepancies exist between the contract documents and the local requirements, the more stringent shall apply.
- C. Contractor shall obtain all required permits prior to the start of the project.
- D. Post permits as required.
- E. Contractor shall pay all permit fees, tap fees and inspection fees. Owner shall pay any required development fees.

#### 1.7. PROTECTION

- A. People
  - 1. Comply with all applicable health and safety regulations. Set barricades and signs as necessary to minimize hazards for building occupants and trades.
  - 2. Equipment, materials or other potential hazards to the public and working occupants of the building shall not be left overnight outside of the designated working or construction areas.
- B. Work
  - 1. Take all necessary measure to protect the work during and after installation to ensure that it will be unblemished, undamaged and clean when turned over to the owner.
- C. Mechanical Systems
  - 1. All specified filters shall be installed in air handling equipment prior to startup. Provide additional sets of filters during construction as required to maintain cleanliness of system.
  - 2. In addition to specified filters, install a roughing filter upstream of mixed air filter. Roughing filter shall consist of two layers of roll filter media clipped and sealed to entering side of filter frame. Change roughing filter as necessary to minimize dust collection on specified filters.
  - 3. Replace filters in existing and new mechanical equipment that was in use during construction prior to turn-over to owner.
  - 4. During periods of excessive dust generation such as drywall sanding, seal off return and exhaust openings and grilles to prevent dust from accumulating in ductwork.
  - 5. If outside air source contains less dust than building air, adjust A/C unit dampers to operate with as much outside air as possible without causing a freezing condition for coil or exceeding capacity of coil to adequately condition supply air.
  - 6. Do not operate any air handling unit without all temporary construction filters, and scheduled filters, pre and final, installed.
  - 7. Replace filters in existing and new mechanical equipment that was in use during construction prior to turn-over to owner.

**D. Equipment and Materials**

1. Deliver equipment in its original unbroken package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations. Provide protective coverings during construction. Identifying labels intact and legible.
2. Immediately upon delivery, identify and inspect materials and equipment delivered to Site to assure compliance with Contract Documents, approved submittals and reviewed Shop Drawings.
3. Protect from loss, damage, dust, water, etc., until notice of completion has been filed. Promptly replace lost, damaged or defective materials and equipment with new at no increase in Contract Sum. Remove damaged or defective materials from site.
4. Do not store equipment or materials outdoors unprotected. Remove improperly stored equipment and materials from site. Contractor shall provide storage in appropriate enclosed warehouse as required at contractors expense.
5. Ductwork and piping shall be delivered to site with ends sealed. Seal shall remain in place until installed. Provide seal on end of all open ductwork and piping at end of day.
6. Refer to Division 1 for additional requirements.

**1.8. OWNER-FURNISHED EQUIPMENT**

- A. All equipment called out in the Specifications or shown on the Drawings as "Owner-Furnished Equipment" or equipment furnished by other Divisions shall be installed and connected under this Contract. Provide all connection components as required, including but not limited to, reducers, pressure regulators, back-flow preventers, flexible connectors, unions, gauges, thermometers, and isolation valves as required by manufacturer's installation requirements or contract document details. Provide rough-ins for all future connections indicated.

**1.9. CUTTING AND PATCHING**

- A. Cut and patch as necessary for the installation of the materials and equipment. Coordinate patching with the architectural contractor.
- B. Do not cut any structural members without prior approval from the architect or structural engineer.

**1.10. OPERATION AND MAINTENANCE MANUAL**

- A. Refer to Division 01 for O&M Manual requirements. Provide most stringent between items noted below and in Division 1. If there are no requirements in Division 1, the requirements below shall apply.
- B. Upon substantial completion of the work, submit one O&M Manual to the engineer for review and comment. Respond to comments and submit a total of 3 copies of the O&M Manual to the architect upon project completion.
- C. Manual shall be in a 3-ring binder with edge and front labels. Include a table of contents and include:
  1. Final approved submittals indicating all model numbers, serial numbers, cut sheets, and all performance criteria on furnished equipment
  2. Installation, Operation and Maintenance Instructions
  3. Parts Lists
  4. Test and Balance Report
  5. Certificates of Inspection

6. Executed Warranties

- D. Provide PDF format copy of O&M manual as noted above. PDF shall be bookmarked with titles per specification section and per piece of equipment within each section.

1.11. WARRANTIES

- A. Provide a one year warranty on all mechanical work installed under contract. Provide an additional 4 year warranty for all refrigerant compressors installed.
- B. Include executed warranties in O&M Manual.
- C. Warranty shall include parts, labor, and shipping and shall cover any damage caused by failures in the covered mechanical systems.

1.12. RECORD DRAWINGS

- A. Refer to Division 01 for requirements. At a minimum comply with the following requirements.
- B. Maintain a set of redlined drawings at the jobsite with all changes to the Contract Documents, whether generated by addenda, change orders, or field conditions, and dimensioned locations of underground utilities. Maintain a daily record of these changes and keep current set of drawings showing these changes. Submit set of redlined drawings to the owner at project close-out.. Record changes and locations of installed systems drawn to scale and fully dimensioned, and as specified in Division 1, but a minimum of:
1. Work concealed behind or within other work, in an inaccessible arrangement.
  2. Mains and branches of piping systems:
    - a. With valves and control devices located and numbered.
    - b. With concealed unions located.
    - c. With items requiring maintenance located (traps, strainers, expansion compensators, tanks, etc.) and clearly labeled..
  3. Underground piping and ducts, both exterior and interior.
  4. Ductwork layouts, including locations of coils, dampers, filters, boxes and similar units.
  5. Concealed control system devices and sensors.
- C. Provide record drawings that illustrate the work of Division 23 as finally constructed. Deliver record drawings to the Architect in reproducible hard copy, Auto CAD or Revit format and PDF format on CD Rom, DVD, or Flash Drive. Also provide PDF format electronic copies of permit set with all revisions and RFI responses noted. Set shall include all architectural, structural, civil, mechanical, electrical, plumbing, low voltage, and food service and all other vendors issued with the project. Provide PDF format of full specification set with all revisions and RFI responses noted. All PDF sets shall be bookmarked per phase, division and per drawing or specification section. A change log shall be provided listing each drawing and specification section and all drawing and specification issues including all addendums, clarifications, RFIs and change orders. Log shall indicate the most current version of each drawing and specification section.
- D. Deliver record drawings to Architect within 30 days of Substantial Completion.

### 1.13. DEMONSTRATION

- A. Provide factory trained personnel to instruct operating staff in maintenance and adjustment and operation of mechanical equipment. Provide instruction during regular work hours prior to acceptance and turn over to operating staff. Scheduling of training shall be at owner's direction. Use operating and maintenance manual and updated as-constructed drawings for instruction purposes.
- B. Demonstrate normal start-up and shut-down, emergency shut-down and seasonal change over. Review operation of safety devices and control systems.
- C. Inspections and Tests:
  - 1. Arrange for all required inspections and tests.
  - 2. Pay all charges.
  - 3. Notify Architect / Engineer two (2) business days before tests.
  - 4. Submit one copy for Owner's records of permits, licenses, inspection reports and test reports.

## PART 2 PRODUCTS

### 2.1. SUBMITTALS

- A. Bidders shall quote on brands and manufacturers of equipment as requested in these Specifications and Drawings. See appropriate section of the Contract Documents for requirements governing the prior approval process.
- B. Coordinate submittals 3 weeks (min.) prior to expected order date so that work will not be delayed by submittals.
- C. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.
- D. Submittals from subcontractors and equipment suppliers are to be carefully checked by the Contractor for space requirements and conformance to the Drawings and Specifications. These submittals shall be so noted by the Contractor prior to forwarding to the Architect/Engineer for checking. No deviations from the Drawings and Specifications will be allowed, recognized or considered unless brought to the attention of the Architect/Engineer at the time the submittals are submitted by the Contractor. Submittals not processed by the Contractor before forwarding to the Architect/Engineer for approval will be returned to the Contractor for his prior processing.
- E. Submittal is for information and record, unless otherwise indicated, and is not a change order request.
- F. Submitting Contractor is responsible for routing reviewed submittals to all parties affected including but not limited to electrical, structural, temperature control, and test and balance subcontractors.
- G. Submittals shall include catalog cut-sheets with submitted products and options clearly identified, written descriptions, and specification sheets detailing the associated product, item and assembly.
- H. No substitution for brands named in the Contract Documents will be considered unless written request has been submitted to the Engineer. Each such request shall include a complete description of the proposed substitute, drawings, cut sheets, performance and test data, and any other data or information necessary for complete evaluation. The burden of proving acceptability of a proposed product rests on the party submitting the request for approval. Request for product approval substitutions shall be submitted in writing to the Engineer a minimum of ten (10) working days in advance of the bid date.



- I. Shop drawings shall include details, installation drawings, assembly drawings, fabrication drawings, diagrams, and other information which show adaptation or installation of Contractor-furnished products or materials for overall project.
- J. The purpose of submittals and shop drawings is to ensure Contractor understands design requirements and demonstrates understanding by indicating and detailing intended materials, methods, and installation practices. Submittals and shop drawings are not a method of requesting substitutions or deviation from Specifications. If discrepancies between submittals, shop drawings, and Contract Documents are discovered either prior to or after submittals and shop drawings are reviewed, requirements of Contract Documents shall take precedence.
- K. Catalog numbers referenced throughout the Division 23 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.
- L. Group complete information of related systems, products, and accessories in a single submittal. If submitted as a hard copy, submittals shall be submitted in a three-ring binder, with separate sections for each type or category of equipment, with labeled tabs indicating the contents of the section. If submitted electronically, the submittal shall be in a PDF file with each section bookmarked with labels. Within each section, each sub item or equipment tag shall be bookmarked with a corresponding tag.
- M. In the front of each submittal binder, the Mechanical Contractor shall include a signed letter from the project Electrical Contractor indicating that the Electrical Contractor has reviewed the mechanical submittals and has verified that the equipment being submitted will conform to the design of the project electrical systems.
- N. After Architect/Engineer review, submittals and shop drawings will be returned together with Submittal Review Sheet which indicates comments on submittals and shop drawings and with specific actions such as "No Exception Taken", "Make Corrections Noted", "Rejected", and "Resubmit". Continue to resubmit submittals and shop drawings until "No Exception Taken" or "Make Corrections Noted-Resubmittal Not Required" action is indicated.
- O. Resubmittals will be reviewed for compliance with comment made on the original submittal only. Clearly identify replied-to comments with a resubmittal number and date. If any other changes are made that are not in reply to comments, clearly identify the changes. Indicate dates of previous submissions and submittal numbers. Direct specific attention to any changes made in addition to those made in reply to previous review comments.
- P. If more than two submittals (either for products, materials, shop drawings, record drawings, or test and balance reports) are made by the Contractor of basis of design, listed general equivalents or substitutions, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants at their consultants current published hourly rate. Such extra fees may be deducted from payments by the Owner to the Contractor.
- Q. Refer to individual specification sections for submittal requirements. However, a minimum, shop drawings shall be submitted for each of the following items as applicable to the project:
  - 1. Air Distribution Devices
  - 2. Automatic Dampers
  - 3. Controls & Control Diagrams including Wiring Plans
  - 4. Ductwork & Ductwork Construction

5. Fans
6. Fire & Smoke Dampers
7. Flexible Ductwork
8. Manual Dampers
9. Duct Insulation & Accessories
10. Thermostats

## 2.2. HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct Hangers Minimum Size," "Minimum Hanger Sizes for Round Duct."
- D. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
- E. Fasteners for all galvanized, stainless steel or aluminum supports shall be stainless steel.
- F. All galvanized supports with coating damaged by drilling, cutting, welding or other means shall be coated with two coats of cold-galvanizing.

## 2.3. EQUIPMENT SUPPORTS

- A. Structural steel for supports: ASTM A36.
- B. Use galvanized members installed in fan plenums or areas of high humidity or condensation, and outside. All fasteners shall be stainless steel. Any damage caused by cutting, drilling, or welding or any other means to galvanized surface must be repaired by apply two coats of cold-galvanizing.
- C. Furnish other members with shop coat of red primer.
- D. Retouch primer after field welding.
- E. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to properly support and anchor HVAC materials and equipment.
- F. Comply with AWS D1.1 for field welding.

## 2.4. SLEEVES

- A. Sleeve Material
  1. Concrete floors, concrete and masonry walls: ASTM A 53, Type E, Grade B, schedule 40 black steel pipe.

2. Drywall partitions: 18 gauge galvanized steel sheet metal.

- B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2". Increase space as required to allow for uninterrupted insulation and free longitudinal movement. Provide larger annular space if required by firestopping product installation instructions.
- C. Sleeves through floor assemblies shall extend 4" above the slab and provide a watertight seal .
- 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.

## 2.5. GROUT

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

## 2.6. ESCUTCHEONS

- A. Split-casting, cast-brass type with chrome finish, with concealed hinge and set screw with an ID to closely fit around pipe, tube and insulation of insulated piping and an OD that completely covers opening.

## 2.7. WALL AND CEILING ACCESS PANELS

- A. Style and type as required for material in which installed.
- B. Size: 24"x24" minimum, as indicated, or as required to allow inspection, service and removal of items served.
- C. 14 gauge minimum sheet metal for doors, 16 gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.
- D. For all doors installed outside, in ambient conditions, in wet areas, or in areas of high humidity , door shall be aluminum construction. Areas included, but not limited to, are outside air plenums, unconditioned penthouses, bathrooms, and kitchens. Door shall be a minimum of 1/8" thick aluminum with 1/4" extruded aluminum frame with mitered and welded corners. Hinge shall be continuous stainless steel.
- E. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.
- F. Prime painted or rust inhibitive paint finish.
- G. UL labeled when in fire-rated construction, 1-1/2 hour rating.

- H. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are fire and/or smoke dampers, mechanical system valves, and equipment needing periodic or replacement maintenance.
- I. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.
- J. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers.
  - 1. For masonry and drywall construction: Milcor Style M.
  - 2. For plastered masonry walls and ceiling: Milcor Style K.
  - 3. For ceramic tile or glazed structural tile: Use stainless steel panels.
  - 4. For aluminum doors: Milcor Style CT, downward swing door.

### PART 3 EXECUTION

#### 3.1. DEMOLITION

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all mechanical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.
- B. The Contractor shall modify, remove, and/or relocate all materials and items so indicated or as required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Survey the project with the Owner's Representative before demolition begins and determine all materials that the Owner specifically chooses to be salvaged. Pre-establish with the Owner locations where salvaged materials are to be stored. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- C. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- D. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.
- E. Ductwork, service lines and piping to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Utilities and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in

such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as herein above specified.

1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material. Insulate to match existing to remain duct if required and seal to existing to maintain vapor barrier.
  2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  4. Insulation: If duct, pipe or equipment insulation to remain is damaged in appearance, performance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality. Seal vapor barrier from new to existing.
- F. Certain work during the demolition and alteration phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate times with the Owner. All overtime costs shall be part of the contract, including any Sunday work.
- G. Include in the contract price all rerouting of existing ductwork, piping, air devices, fixtures, and similar items and the reconnecting of existing fixtures and devices as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Furnish all temporary ductwork and piping, and similar items as required to maintain service for the existing areas with a minimum of interruption.
- H. Within the remodeled or alteration areas where existing ceilings are being removed and new ceilings are installed, all existing air devices, other ceiling mounted devices and their appurtenances shall be removed and reinstalled into the new ceiling, unless otherwise shown or specified.
- I. Within the remodeled or alteration areas where existing walls are being removed, all existing fixtures, thermostats, other materials and equipment and their appurtenances shall be removed and relocated if necessary where required by the remodel work either shown or specified.
- J. All existing air devices materials, equipment and appurtenances not included in the remodel or alteration areas are to remain in place and shall remain in service.
- K. Mechanical equipment and building systems equipment, and similar items which are to remain but which are served by controls, ductwork or piping that is disturbed by the remodeling work, shall be reconnected in such a manner as to leave it in proper operating condition.
- L. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and recycled or disposed of legally.

### 3.2. INSTALLATION

- A. Execute work such that all components function together as a complete, workable system. Make slight alterations necessary to make adjustable parts fit with fixed parts. Execute work to contribute to efficiency of operation, accessibility, sightliness, and minimum maintenance clearances. Leave equipment properly adjusted and in working order.
- B. Verify dimensions indicated and report any error or inconsistency before commencing work.
- C. Coordinate work with other trades through the General Contractor so that equipment, especially in the ceiling, will fit to patterns of finished materials, and locate all elements to carry harmony of architectural

design throughout the building. Coordinate work with other trades to avoid conflicts, especially in places where close, careful fitting is required. Coordination problems and field solutions must be approved through the General Contractor and the Architect/Engineer before proceeding with work.

- D. Conform and accommodate systems to the building structure, equipment and usage so that they do not interfere with the operation of any other system or operational part of the building.
- E. Preparation: Final installation of materials and equipment shall be based on actual dimensions and conditions at the job site. Field measure for materials or equipment requiring exact fit.
- F. Workmanship: Perform work in accordance with good commercial practice and all applicable trade standards, including current SMACNA standards. The finished appearance of the work shall be of equal importance with its mechanical efficiency.
- G. Clearances: The Subcontractors working under this Division shall be responsible for the sufficiency of the size of shafts and chases, and clearances in double partitions and hung ceilings for proper equipment installation. Cooperate with Contractors of other Divisions whose work is in the same space and advise the General Contractor of requirements. Such spaces and clearances shall be kept to the minimum size required.
  - 1. Install equipment, ductwork, piping and accessories:
    - a. Straight and true.
    - b. Aligned with other work and with general lines of the building.
    - c. Concealed in occupied spaces, unless noted otherwise.
    - d. Out-of-the-way with maximum passageway and headroom remaining in each space.
  - 2. Except as otherwise indicated, arrange mechanical services and overhead equipment to not obstruct windows, doors or other openings. Clearance shall be a minimum of:
    - a. 7'-6" headroom in mechanical spaces.
    - b. 9'-6" headroom in unfinished or shell spaces.
  - 3. Give the right-of-way to piping systems required to slope for drainage (over other service lines and ductwork).
- H. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to, valves, shock absorbers, traps, cleanouts, motors, controllers, switchgear, drain points, manual dampers, and smoke and fire dampers. If required for accessibility, the Contractor shall furnish access doors for this purpose, subject to the following:
  - 1. Access door shall be sized to permit removal of equipment, or 24"x24" if used for service only.
  - 2. Furnish doors to trades performing work in which they are to be installed. Group valves, devices and other equipment to permit use of minimum number of access doors.
  - 3. Doors shall be lockable and suitable for painting to match adjacent finishes.
- I. Minor deviations from the Drawings may be allowed to provide for better equipment accessibility. The General Contractor shall approve of any change prior to this Contractor making the change.
- J. Properly locate anchors, chases, recesses and openings required for the proper installation of the work. Arrange with the proper contractors for the building of anchors, etc., and for the leaving of the required chases, recesses and openings in sufficient time to be installed in the normal course of work. Install equipment and materials in accordance with manufacturer recommendations unless specifically indicated otherwise, or where local codes or regulations take precedence. This includes the performance of tests

the manufacturer recommends. It is intended that anything, whether labor or materials, which is usually furnished as a part of any equipment specified and which is necessary for the best operation shall be furnished as a part of the contract without additional cost, whether or not shown or described.

- K. Anchor and secure all equipment to the building substrate and structure. Provide all supplemental steel, anchors and attachments as required to properly support and anchor materials in this division.
- L. Erect, install, and secure components in a structurally sound and appropriate manner.
- M. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.
- N. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.
- O. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking, or other disfigurement.
- P. Conduct work in a manner to avoid injury or damage to previously placed work. Any work so impaired or damaged shall be replaced at no expense to Owner.
- Q. Fabricate and install materials true to line, plumb, and level.
- R. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents, and other imperfections.
- S. Testing: See individual Specification sections in Division 23 for testing of mechanical work.
- T. Protection: Cover and seal ends of pipe and ductwork during construction to prevent entry of foreign material and moisture. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work. All air handling equipment shall be fitted with all specified filters prior to any startup or operation. Provide additional sets of filters during construction as required to maintain cleanliness of system. Filter to be as scheduled or at a minimum high-quality, 30% min. efficient pleated filters. The use of "construction filters" is NOT authorized. Failure to provide required filters will cause the contractor to provide, at their own cost, the services of an independent third party provider to clean and sterilize all contaminated duct systems.
- U. Freeze Protection: Do not run piping in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection. Water piping exposed to freezing conditions shall be insulated as specified, with aluminum weather jacket and electric heating cable, thermostatically controlled, as specified under 23 0533. Heat tracing shall be coordinated with Electrical Contractor and installed on all exterior water piping, per applicable Division 23 and 26 Specifications.
- V. Scaffolding, Rigging and Hoisting: Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required.
- W. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls and roofs will not be delayed or need to be removed. Otherwise, advise General Contractor of opening requirements to be maintained for the subsequent entry of equipment.
- X. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.

- Y. Where products to be installed on an existing roof are too heavy to be hand-carried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.
- Z. Materials and apparatus required for the work to be new, of first-class quality, and to be furnished, delivered, installed, connected and finished in every detail. Equipment shall be selected and arranged such that it fits properly into the building space provided. Where no specific kind or quality of material is given, a first-class standard article shall be furnished.
- AA. Equipment start-up and adjustment of all HVAC equipment and water heaters shall be performed by certified factory representatives of the respective equipment manufacturer.
- AB. Furnish the services of an experienced superintendent, who will be constantly in charge of installation of the work, together with all skilled tradesmen, fitters, helpers and labor required to unload, transfer, erect, connect, adjust, start, operate and test each system.

### 3.3. HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Hangers Exposed to View: Threaded rod and angle or channel supports. Coordinate with Architect for required painting of exposed supports.

### 3.4. THROUGH PENETRATIONS

- A. References:
  - 1. ASTM E 814: Standard Test Methods for Fire Tests of Through-Penetration Firestops.
  - 2. UL 1479 Standard for Fire Tests of Through-Penetration Firestops, including optional air leakage test.
- B. Non-Rated Walls
  - 1. All penetrations through concrete or masonry walls shall be sleeved with a steel standard weight pipe sleeve which shall be grouted in place. Closures shall be provided between the pipe and sleeve wherever an exterior wall or is penetrated. Use Link-Seal modular rubber seals as manufactured by Thunderline Corp., Wayne, Michigan.
- C. Fire Resistance Rated Assemblies
  - 1. Performance Requirements
    - a. Penetrations: Provide through-penetration firestop systems that are installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of assembly penetrated.
      - 1) Install complete through penetration firestop systems that have been tested and are listed by recognized testing agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of site conditions.
      - 2) F-Rated Systems: Install through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814 or UL 1479, but not less than the fire resistance rating of the assembly being penetrated.



- 3) T-Rated Systems: Install through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814 or UL 1479, where required by the Building Code.
- 4) L-Rated Systems: Install through-penetration firestop systems with L-ratings as determined by UL 1479 and as required by the owner, architect or Authority Having Jurisdiction.
- 5) W-Rated Systems: Install through-penetration firestop systems meeting W-Rating Class 1 Requirements as determined by the UL Water Leakage Test for systems tested and listed in accordance with UL 1479 and as required by the owner, architect or Authority Having Jurisdiction.
- 6) For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
- 7) For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

## 2. Schedules

- a. Unless otherwise noted on the drawings. Provide the fire stop systems or their approved equal as listed below:
  - 1) Metallic Pipe, Metallic Ductwork, Non-Metallic Pipe smaller than 2".
  - 2) a. 3M Fire Barrier Sealant CP 25WB+:
  - 3) b. Material Description: Intumescent latex/water based caulk
  - 4) c. Formulation: No-sag, non-halogen formula. Fast drying. Paintable
  - 5) d. Water Resistance: Provide water resistant seal

## 3. Installation of Through-Penetration Firestop Systems

- a. General
  - 1) Install through-penetration firestop systems to comply with "Performance Requirements" above and firestop systems manufacturer's written installation instructions and published drawings for products and applications indicated.
  - 2) Install forming/damming/backing materials and other accessories of types required to support fill material during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop system.
  - 3) Install fill materials for firestop systems by proven techniques to produce the following results:
  - 4) Fill voids and cavities formed by openings, forming materials, accessories and penetrating items as required to achieve the fire-resistance ratings indicated.
  - 5) Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
- b. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining surfaces.
- c. Watertight. Meets UL Water Leakage Test - Class 1 requirements for systems tested and listed in accordance with the criteria of ASTM E 814 (UL 1479) Standard Test Method for

Fire Tests of Through-Penetration Fire Stops. W Rating - Class 1 requirements include a minimum water column exposure of 3 ft. for 72 hours prior to the standard time / temperature curve for the fire test.

4. Field Quality Control

- a. Proceed with enclosing through-penetration firestop systems with other construction only after inspection and approval by Authority Having Jurisdiction.
- b. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5. GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.6. CLEANING

- A. Cleaning During Construction and Final Cleaning: Comply with General Requirements.
- B. Clean exposed surfaces of piping, hangers, ducts and other exposed items of grease, dirt or other foreign material. Clean and polish plumbing fixtures, fittings, and exposed plated piping. Leave clean and free from paint, grease, dirt, etc. Remove labels from exposed equipment. Carefully and thoroughly clean all items of equipment. If finishes have been damaged, refinish to original condition using factory-provided matching paint, and leave all equipment in proper working order and intended appearance. At the completion of the work, remove all rubbish, cleaning supplies and debris resulting from the operation and leave spaces clean and ready to use.
- C. Replace air filters in all equipment immediately prior to Owner's Date of Acceptance. Clean ducts, blowers and coils if units were operated without filters at any time during construction. Provide one (1) complete set of clean filters to Owner at project turnover.
- D. Flush all piping systems free of foreign substances before installing valves or making final connections. Notify the Owner/Architect seven (7) days in advance of final flushing so that Owner/Architect may attend and verify the cleanliness of the pipe.

3.7. MECHANICAL SERVICE AND MAINTENANCE

- A. Include four (4) complete service and maintenance calls plus emergency calls spaced at reasonable intervals throughout one (1) year warranty period. During each maintenance call, technicians shall:
  1. Verify proper working order of safety devices on each piece of equipment.

2. Check lubrication of all moving parts and lubricate as necessary.
3. Verify proper operating temperatures, pressures, flows, etc. for each major piece of equipment.

**END OF SECTION 23 0010**

**SECTION 23 0130.51 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Cleaning of HVAC duct system, equipment, and related components.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 4000 - Quality Requirements: Additional requirements for testing and inspection agencies.

**1.3. PRICE AND PAYMENT PROCEDURES**

- A. See Section 01 2100 - Allowances, for cash, testing, and quantity allowances affecting this section.
- B. See Section 01 2200 - Unit Prices, for additional unit price requirements.

**1.4. DEFINITIONS**

- A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.
  - 1. Above-ceiling plenum for return air is required to be cleaned.
  - 2. Exhaust-only system is required to be cleaned.

**1.5. REFERENCE STANDARDS**

- A. NADCA ACR - Assessment, Cleaning and Restoration of HVAC Systems; 2013.
- B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.
- C. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

**1.6. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
- C. Material Safety Data Sheets (MSDS): For all chemical products proposed to be used in the cleaning process; submit directly to Owner.
- D. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

**1.7. QUALITY ASSURANCE**

- A. Information Available to Contractor: Upon request, Owner will provide the following:
  - 1. One copy of original construction drawings of HVAC system.

- B. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
  - 1. Certified by one of the following:
    - a. NADCA, National Air Duct Cleaners Association: [www.nadca.com](http://www.nadca.com)
  - 2. Having minimum of three years documented experience.
  - 3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

## PART 2 PRODUCTS

### 2.1. TOOLS AND EQUIPMENT

- A. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

## PART 3 EXECUTION

### 3.1. PROJECT CONDITIONS

- A. Comply with applicable federal, state, and local requirements.
- B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.
- C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.
- D. Obtain Owner's approval of proposed temporary locations for large equipment.
- E. Designate a decontamination area and obtain Owner's approval.
- F. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.
- G. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

### 3.2. EXAMINATION

- A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.
- B. Start of cleaning work constitutes acceptance of existing conditions.
- C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.
- D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

### 3.3. PREPARATION

- A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.
- B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.
- C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.
- D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
  - 1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
  - 2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
  - 3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.
- E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

### 3.4. CLEANING

- A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.
- B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.
- C. Ducts: Mechanically clean all portions of ducts.
- D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.
- E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.
- F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.
- G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.
- H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

### 3.5. REPAIR

- A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

- B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.
- C. Reseal new openings in accordance with NADCA Standard 05.
- D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.
- E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

### 3.6. FIELD QUALITY CONTROL

- A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.
- B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.
- C. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.
- D. Notify Architect when cleaned components are ready for inspection.
- E. When directed, re-clean components until they pass.
- F. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

### 3.7. ADJUSTING

- A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

### 3.8. WASTE MANAGEMENT

- A. Double-bag waste and debris in 6 mil, 0.006 inch thick polyethylene plastic bags.
- B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

**END OF SECTION 23 0130.51**

**SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. General requirements for general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.
- B. IEEE 841 - IEEE Standard for Petroleum and Chemical Industry- Premium Efficiency, Severe-Duty, Totally Enclosed, Fan-Cooled (TEFC) Squirrel Cage Induction Motors UP to and Including 370 kW (500 HP), 2009.
- C. NEMA MG 1 - Motors and Generators; 2017.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for Commercial use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
- B. Conform to NFPA 70.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of high efficiency motors.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.5. DELIVERY, STORAGE, AND HANDLING**

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

**1.6. WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.



## 1.7. COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

## PART 2 PRODUCTS

### 2.1. GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service:
  - 1. Motors 1 HP and Smaller: 120 volts, single phase, 60 Hz.
- B. Construction:
  - 1. Open drip-proof type except where specifically noted otherwise.
  - 2. Design for continuous operation in 104 degrees F environment.
  - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- D. Wiring Terminations:
  - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
  - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

### 2.2. APPLICATIONS

- A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.
- B. Single phase, multi-speed motors: Variable torque, permanent split-capacitor type.
- C. Single phase motors 1/20 HP and smaller: Shaded-pole type.
- D. Single phase motors for shaft mounted fans: Split phase type.
- E. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.
- F. Single phase motors for fans: Capacitor start type.
- G. Single phase motors for fans: Capacitor start, capacitor run type.
- H. Motors located in exterior locations, air cooled condensers, and humidifiers: Totally enclosed type.

- I. Motors located in outdoors and in humidifiers: Totally enclosed weatherproof epoxy-treated type.
- J. Motors located outdoors: Totally enclosed weatherproof epoxy-sealed type.
- K. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- L. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

### 2.3. SINGLE PHASE POWER - SPLIT PHASE MOTORS

- A. Starting Torque: Less than 150 percent of full load torque.
- B. Starting Current: Up to seven times full load current.
- C. Breakdown Torque: Approximately 200 percent of full load torque.
- D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
- E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

### 2.4. SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to six times full load current.
- C. Multiple Speed: Through tapped windings.
- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

### 2.5. SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.
- C. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.
- E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
- G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

PART 3 EXECUTION

3.1. INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

**END OF SECTION 23 0513**

**SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.

**1.2. REFERENCE STANDARDS**

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. AABC MN-1 - AABC National Standards for Total System Balance; 2002.
- C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- D. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, Eighth Edition.
- E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
  - 1. Include at least the following in the plan:
    - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    - d. Final test report forms to be used.
    - e. Procedures for formal deficiency reports, including scope, frequency and distribution.
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
  - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.1. GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
  - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  - 3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
  - 4. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

### 3.2. EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - 5. Duct systems are clean of debris.
  - 6. Fans are rotating correctly.
  - 7. Fire and volume dampers are in place and open.
  - 8. Air coil fins are cleaned and combed.
  - 9. Access doors are closed and duct end caps are in place.
  - 10. Air outlets are installed and connected.
  - 11. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

### 3.3. ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

### 3.4. RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

### 3.5. AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Measure air quantities at air inlets and outlets.
- C. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

### 3.6. SCOPE

- A. Test, adjust, and balance the following:
  - 1. Fans.
  - 2. Air Terminal Units.
  - 3. Air Inlets and Outlets.

### 3.7. MINIMUM DATA TO BE REPORTED

- A. Return Air/Outside Air:
  - 1. Design return air flow.
  - 2. Actual return air flow.
- B. Exhaust Fans:

1. Air flow, specified and actual.
  2. Total static pressure (total external), specified and actual.
- C. Air Distribution Tests:
1. Air terminal number.
  2. Room number/location.
  3. Design air flow.
  4. Percent of design air flow.

**END OF SECTION 23 0593**

**SECTION 23 0713 - DUCT INSULATION****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Duct insulation.
- B. Duct liner.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 8400 - Firestopping.

**1.3. REFERENCE STANDARDS**

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.
- E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.
- F. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2011.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, water-vapor permeance, list of materials and thickness for each service, and locations.



- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

#### 1.5. QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section

#### 1.6. DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness, ASTM standard designation, type and grade, and maximum use temperature.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

#### 1.7. COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 1.8. SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

#### 1.9. FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

### PART 2 PRODUCTS

#### 2.1. REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

## 2.2. GLASS FIBER, FLEXIBLE

### A. Manufacturer:

1. Knauf Insulation; Friendly Feel Duct Wrap: [www.knaufusa.com](http://www.knaufusa.com).
2. Johns Manville; Microlite: [www.jm.com](http://www.jm.com).
3. Owens Corning Corporation; SOFTR All-Service Duct Wrap: [www.ocbuildingspec.com](http://www.ocbuildingspec.com).
4. CertainTeed Corporation; SoftTouch Duct Wrap: [www.certainteed.com](http://www.certainteed.com).

### B. Insulation: Mineral or glass fibers bonded with a thermosetting resin; ASTM C553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket; flexible, noncombustible blanket.

1. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 250 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

### C. Vapor Barrier Jacket:

1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
2. Secure with pressure sensitive tape.
3. ASJ (All Service Jacket): White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
4. ASJ-SSL (Self-Sealing Lap): White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
5. FSK (Foil-Scrim-Kraft) Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
6. FSP (Foil-Scrim-Polyethylene) Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
7. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

### D. Vapor Barrier Tape:

1. Manufacturers:
  - a. ABI, Ideal Tape Division; 491 AWF FSK.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
  - c. Compac Corporation; 110 and 111.
  - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

### E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

### 2.3. DUCT LINER

#### A. Manufacturers:

1. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
2. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
3. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
4. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).

#### B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.

1. Fungal Resistance: No growth when tested according to ASTM G21.
2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
3. Service Temperature: Up to 250 degrees F.
4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
5. Minimum Noise Reduction Coefficients:
  - a. 1 inch Thickness: 0.45.

#### C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

##### 1. Manufacturers:

- a. \_\_\_\_\_.
- b. \_\_\_\_\_.
- c. \_\_\_\_\_.

#### D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

### 3.2. INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated ducts conveying air below ambient temperature:
  1. Provide insulation with vapor barrier jackets.
  2. Finish with tape and vapor barrier jacket.
  3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ducts conveying air above ambient temperature:
  1. Provide with or without standard vapor barrier jacket.
  2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. External Duct Insulation Application:
  1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
  2. Secure insulation without vapor barrier with staples, tape, or wires.
  3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
  4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
  5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- E. Duct Liner Application:
  1. Adhere insulation with adhesive for 100 percent coverage.
  2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
  3. Seal and smooth joints. Seal and coat transverse joints.
  4. Seal liner surface penetrations with adhesive.
  5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

### 3.3. PENETRATIONS

- A. Insulation Installation at Roof and Exterior Wall Penetrations: Install insulation continuously through roof penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof or inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside flashing at least 2 inches below top of roof flashing or additionally overlap wall flashing at least 2 inches.
  4. Seal jacket to flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4. INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.5. FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

### 3.6. FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Test and Inspections:
  1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.7. INDOOR DUCT INSULATION SCHEDULE

- A. Items Not Insulated:
  1. Factory insulated flexible ducts.
  2. Factory insulated plenums and casings.
  3. Flexible connectors.
  4. Vibration control devices.
  5. Factory insulated access doors and panels.
- B. Concealed and exposed, Supply Air Duct and Plenum Insulation shall be the following:
  1. Glass Fiber, Flexible: 2 inches thick and 1.0-lb/cu.ft. nominal density.
- C. Concealed and exposed, Outdoor Air Duct and Plenum Insulation shall be the following:
  1. Glass Fiber, Flexible: 2 inches thick and 1.0-lb/cu.ft. nominal density.
- D. Concealed, Exhaust Air Duct and Plenum Insulation between isolation damper and penetration of building exterior shall be the following:

1. Glass-Fiber, Flexible: 2 inches thick and 1.0-lb/cu.ft. nominal density.
- E. Transfer Air Duct Liner shall be the following:
1. Glass-Fiber: 1-inch thick.

**END OF SECTION 23 0713**

**SECTION 23 3100 - HVAC DUCTS AND CASINGS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Metal ductwork.
- B. Flexible duct.
- C. Casing and plenums.
- D. Duct cleaning.

**1.2. RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 07 8400 - Firestopping.
- C. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Cleaning ducts after completion of installation.
- D. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
- E. Section 23 0713 - Duct Insulation: External insulation and duct liner.
- F. Section 23 3300 - AIR DUCT ACCESSORIES.
- G. Section 23 3600 - Air Terminal Units.
- H. Section 23 3700 - Air Outlets and Inlets.

**1.3. REFERENCE STANDARDS**

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.



- K. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012, 2nd Edition.
- L. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

#### 1.4. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials.
- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 3" pressure class and higher systems.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).
- E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

#### 1.5. QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

#### 1.6. FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

### PART 2 PRODUCTS

#### 2.1. DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.
- B. Ducts: Galvanized steel, unless otherwise indicated.
- C. Low Pressure Supply (Heating Systems): 2 inch w.g. pressure class, galvanized steel.
- D. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.
- E. Return and Relief: 2" inch w.g. pressure class, galvanized steel.
- F. General Exhaust: 2" inch w.g. pressure class, galvanized steel.

#### 2.2. MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
  3. For Use With Flexible Ducts: UL labeled.
  4. Manufacturers:
    - a. Carlisle HVAC Products; Hardcast Iron-Grip 601 Water Based Duct Sealant: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
  3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
  4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

### 2.3. DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

### 2.4. MANUFACTURED DUCTWORK AND FITTINGS

- A. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
  1. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
  2. Maximum Velocity: 4000 fpm.
  3. Temperature Range: Minus 10 degrees F to 160 degrees F.
- B. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
  1. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
  2. Maximum Velocity: 4000 fpm.
  3. Temperature Range: Minus 20 degrees F to 210 degrees F.
- C. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

## 2.5. CASINGS

- A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.
- B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.
- C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

## PART 3 EXECUTION

### 3.1. INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or duct opening closure film on open ductwork to prevent construction dust from entering ductwork system. Ends of duct shall be sealed at the end of each day. Duct and fittings shall be delivered to job site with ends covered.
- D. All longitudinal and transverse joints, seams and duct sidewall penetrations, regardless of pressure classification, shall be sealed with duct sealer. Follow SMANCA Table 1-2, Seal Class A for all supply, return and exhaust ductwork.
- E. Duct sealant shall be applied per manufacturer's instructions. Minimum drying time shall be allowed per manufacturer's instructions. Additional time for drying shall be allowed in climates where temperature or humidity may affect the curing of the sealant. Sealant shall be allowed to completely dry and harden before air is circulated through the ductwork.
- F. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Use double nuts and lock washers on threaded rod supports.
- I. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.
- J. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- K. At exterior wall louvers, seal duct to louver frame .

### END OF SECTION 23 3100

**SECTION 23 3300 - AIR DUCT ACCESSORIES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Fire dampers.
- D. Flexible duct connections.
- E. Volume control dampers.
- F. Miscellaneous products:
  - 1. Duct opening closure film.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 23 0548 - Vibration and Seismic Controls for HVAC.
- C. Section 23 3100 - HVAC Ducts and Casings.
- D. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

**1.3. REFERENCE STANDARDS**

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
- E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

**1.4. DELIVERY, STORAGE, AND HANDLING**

- A. Protect dampers from damage to operating linkages and blades.

**PART 2 PRODUCTS****2.1. AIR TURNING DEVICES/EXTRACTORS**

- A. Manufacturers:
  - 1. Carlisle HVAC Products: [www.carlislehvac.com](http://www.carlislehvac.com).

2. Elgen Manufacturing: [www.elgenmfg.com](http://www.elgenmfg.com).
  3. Krueger: [www.krueger-hvac.com](http://www.krueger-hvac.com).
  4. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
  5. Titus: [www.titus-hvac.com](http://www.titus-hvac.com).
  6. Ward Industries, a brand of Hart and Cooley, Inc: [www.wardind.com/#sle](http://www.wardind.com/#sle).
- B. Multi-blade device with airfoil blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps. Similar to Carlisle Dynair Hollow Vane and Rail (Double Wall Vane)

## 2.2. BACKDRAFT DAMPERS - METAL

- A. Manufacturers:
1. Greenheck; : [www.greenheck.com](http://www.greenheck.com)
  2. Louvers & Dampers, Inc: [www.louvers-dampers.com](http://www.louvers-dampers.com).
  3. Nailor Industries Inc: [www.nailor.com](http://www.nailor.com).
  4. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
- B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

## 2.3. FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:
1. Carlisle HVAC Products: [www.carlislehvac.com](http://www.carlislehvac.com).
  2. Elgen Manufacturing: [www.elgenmfg.com](http://www.elgenmfg.com).
  3. Ventfabrics :[www.ventfabrics.com/](http://www.ventfabrics.com/)
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Inside applications other than corrosive environments, fume hood exhaust, or kitchen exhaust.
    - a. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric compliant with NFPA 90A, minimum density 30 oz per sq yd. Net Fabric Width: Approximately 3 inches wide. Similar to Ventfabric Ventglas.
    - b. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.
    - c. Suitable for temperatures between -20° F and 200° F.
    - d. Suitable for +/- 10" w.g. static pressure while being airtight and waterproof.
  2. Outside applications other than corrosive environments, fume hood exhaust, or kitchen exhaust.

- a. Fabric: UL listed fire-retardant woven glass fabric double coated with Hypalon compliant with NFPA 90A, minimum density 26 oz per sq yd. Net Fabric Width: Approximately 3 inches wide. Similar to Ventfabric Ventlon.
  - b. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.
  - c. Suitable for temperatures between -10° F and 200° F.
  - d. Suitable for +/- 10" w.g. static pressure while being airtight and waterproof.
3. Indoor or outdoor application for corrosive environments or fume hoods.
- a. Fabric: UL listed fire-retardant woven glass fabric coated with Teflon compliant with NFPA 90A, minimum density 14 oz per sq yd. Net Fabric Width: Approximately 3 inches wide. Similar to Ventfabric Ventlel.
  - b. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.
  - c. Suitable for temperatures between -20° F and 200° F.
  - d. Suitable for +/- 10" w.g. static pressure while being airtight and waterproof.
- D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- E. Maximum Installed Length: 14 inch.

#### 2.4. VOLUME CONTROL DAMPERS

- A. Manufacturers:
- 1. Greenheck; : [www.greenheck.com](http://www.greenheck.com)
  - 2. Louvers & Dampers, Inc: [www.louvers-dampers.com](http://www.louvers-dampers.com).
  - 3. Nailor Industries Inc: [www.nailor.com](http://www.nailor.com).
  - 4. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Single Blade Dampers:
- 1. Blade: 24 gage, 0.0239 inch, minimum.
  - 2. Shaft: 1/2" square rod operator with end bearings and gasket seal at duct penetrations. Terminate shaft in damper frame with bushings.
- D. Multi-Blade Damper: Fabricate of 3V style opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- 1. Blade: 18 gage, 0.0478 inch, minimum.
  - 2. Shaft: 1/2" square rod operator with end bearings and gasket seal at duct penetrations. Terminate shaft in damper frame with bushings.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- F. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Minimum 12 gauge construction.
2. On externally insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters with height equivalent to insulation thickness.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

## 2.5. DAMPER OPERATORS

- A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
  1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
  2. Provide one operator for maximum 36 sq ft damper section.

## 2.6. MISCELLANEOUS PRODUCTS

- A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
  1. Thickness: 2 mils.
  2. High tack water based adhesive.
  3. UV stable light blue color.
  4. Elongation Before Break: 325 percent, minimum.
  5. Manufacturers:
    - a. Carlisle HVAC Products; Dynair Duct Protection Film: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
    - b. Elgin; Shrink Wrap with PSA: [www.elgenmfg.com](http://www.elgenmfg.com)

## PART 3 EXECUTION

### 3.1. PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

### 3.2. INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Install duct opening closure film on open ductwork at end of day. All ductwork delivered to site shall have ends covered with closure film.
- C. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Provide insulated duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, duct mounted airflow measuring stations and elsewhere as indicated. Provide access door at smoke detectors and humidifiers. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Review locations prior to fabrication.

- E. For ductwork under 12" in longest dimension, provide access door size to allow replacement of fusible link or as required for equipment service. For ductwork between 12" to 20" in longest dimension, provide minimum 12"x12" access door. For ductwork between 22" to 36" in longest dimension, provide minimum 18"x18" access door. For ductwork above 36" in longest dimension, provide minimum 24"x24" access door. Use angle iron bracing as required to make door frame a rigid assembly.
- F. Check duct connections at access doors for air leakage or condensation. Correct conditions found.
- G. Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required. Provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.
- H. Provide duct access door(s) for all rated dampers in accordance with NFPA 90A, identify each access door with 1/2" high stenciled letters as 'Fire Damper', 'Smoke Damper', and 'Combination Fire/Smoke Damper'.
- I. At fans and motorized equipment associated with ducts, except kitchen grease exhaust fans, provide flexible duct connections immediately adjacent to the equipment.
- J. At equipment supported by vibration isolators, except kitchen grease exhaust fans, provide flexible duct connections immediately adjacent to the equipment; see Section 22 0548.
- K. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.
- L. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off. Locate dampers in accessible location.
- M. Use splitter dampers only where indicated.
- N. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 3600 - Air Terminal Units. Locate dampers in accessible location.
- O. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**END OF SECTION 23 3300**



## **SECTION 23 3413 - AXIAL HVAC FANS**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Propeller fans.

#### **1.2. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on axial fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

### **PART 2 PRODUCTS**

#### **2.1. HIGH VOLUME - LOW SPEED (HVLS) FANS**

- A. Manufacturers:
  - 1. MacroAir.
  - 2. Big Ass Fans.
  - 3. Humongous Fan.
- B. Impeller: Shaped steel or anodized aluminum blade with heavy hubs, statically and dynamically balanced, locked to shaft, directly connected to motor or provided with V-belt drive.
- C. Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.

### **PART 3 EXECUTION**

#### **3.1. INSTALLATION**

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

## **END OF SECTION 23 3413**

**SECTION 23 3423 - HVAC POWER VENTILATORS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Cabinet exhaust fans.

**1.2. REFERENCE STANDARDS**

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- B. AMCA 99 - Standards Handbook; 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

**1.3. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

**1.4. FIELD CONDITIONS**

- A. Permanent ventilators may not be used for ventilation during construction.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Carnes, a division of Carnes Company Inc: [www.carnes.com/#sle](http://www.carnes.com/#sle).
- B. Greenheck Fan Corporation: [www.greenheck.com/#sle](http://www.greenheck.com/#sle).
- C. Loren Cook Company: [www.lorencook.com/#sle](http://www.lorencook.com/#sle).
- D. PennBarry, Division of Air System Components: [www.pennbarry.com/#sle](http://www.pennbarry.com/#sle).
- E. Twin City Fan & Blower: [www.tcf.com/#sle](http://www.tcf.com/#sle).

**2.2. POWER VENTILATORS - GENERAL**

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### 2.3. CABINET EXHAUST FANS

- A. Centrifugal Fan Unit: Direct driven with minimum 20 ga. galvanized steel housing lined with acoustic insulation, vibration isolated motor, gravity backdraft damper in discharge.
- B. Wheel: Centrifugal forward curved type, galvanized steel construction.
- C. Motor: Open drip-proof type with permanently lubricated bearings.
- D. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and fan mounted switch reachable from access panel.
- E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

**END OF SECTION 23 3423**

**SECTION 23 3700 - AIR OUTLETS AND INLETS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Diffusers.
- B. Registers/grilles.

**1.2. RELATED REQUIREMENTS**

- A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

**1.3. REFERENCE STANDARDS**

- A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

**1.5. QUALITY ASSURANCE**

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Krueger: [www.krueger-hvac.com](http://www.krueger-hvac.com).
- B. Nailor: [www.nailor.com](http://www.nailor.com)
- C. Price Industries: [www.price-hvac.com](http://www.price-hvac.com).
- D. Titus: [www.titus-hvac.com](http://www.titus-hvac.com).

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.

- D. Provide all screws, bolts, nuts, inserts, and material required for attaching air devices to duct, walls, floors, and ceilings.
- E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

3.2. AIR OUTLET AND INLET SCHEDULE

- A. See plan sheets for diffuser types and performance requirements.

**END OF SECTION 23 3700**

**SECTION 26 0010 - BASIC ELECTRICAL REQUIREMENTS****PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

- A. This Section supplements Division 1, General Requirements.
- B. Where contradictions occur between this Section and Division 1, the more stringent of the two shall apply. Architect and Engineer shall decide which is most stringent.
- C. Provisions of this section shall also apply to all sections of Division 26 and Division 28.
- D. The specifications are complementary to the drawings and their requirements shall have the same priority as the drawings

**1.2. COORDINATION WITH OTHER TRADES****A. Contract Documents:**

- 1. General: The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the electrical work and its interface with other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.
- 2. Work out all conditions in advance of installation. If necessary, and before work proceeds in those areas, prepare coordination drawings showing all work in congested areas. Provide additional work necessary to overcome congested conditions at no increase in contract sum.
- 3. Coordinate the electrical work to the progress of the work of other trades.
- 4. Complete the entire installation as soon as the condition of the building will permit.
- 5. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install electrical and electric systems within the cavity space allocation in the following order:
  - a. Lighting.
  - b. Steam and condensate piping.
  - c. Plumbing piping.
  - d. Mechanical ductwork.
  - e. Fire sprinkler piping.
  - f. Air diffusers.
  - g. Domestic water piping.
  - h. Hydronic piping.
  - i. Pneumatic control piping.

**B. Discrepancies:**

- 1. Examine Drawings and Specifications.
- 2. Report any discrepancies to the Architect and obtain written instructions before proceeding.

3. Should there be a conflict within or between the Specifications or Drawings, the more stringent or higher quality requirements shall apply. The determination of the more stringent or higher quality shall lie with the Architect.
4. Items called for in either specifications or drawings shall be required as if called for in both.
5. Be responsible for providing proper documentation of equipment product data and shop drawings to all entities providing service.
6. Coordination Drawings:
  - a. Acceptance by the Architect does not imply acceptance of any deviations from contract documents requirements or acceptance of uncoordinated work. Review is for general conformance to the design concept and general compliance with the information given in the contract documents.

### 1.3. COORDINATION WITH EXISTING OCCUPIED AREAS

- A. Minimize disruptions to operation of electrical systems in occupied areas.
- B. Coordinate any required disruptions with the Owner, one week in advance.
- C. Provide temporary connections to prevent long disruptions.

### 1.4. DELEGATED DESIGN BY CONTRACTOR

- A. The construction of this building requires the Contractor to design several systems or subsystems. All such designs shall be the complete responsibility of the Contractor.
- B. Systems or subsystems which require engineering responsibility by the Contractor include, but are not limited to:
  1. Any system not fully detailed.
  2. Equipment supports, not fully detailed.
  3. Conduit hangers and anchors not specified in these documents, or catalogued by the manufacturer.
  4. Lighting controls and wiring.
  5. Fire Alarm Systems.
  6. Conduit systems for Data, and Fire Alarm.

### 1.5. REGULATORY REQUIREMENTS

- A. Codes: Comply with the codes adopted by authority having jurisdiction (which shall include but not be limited to):
  1. Applicable editions of NFPA.
  2. Requirements of Fire Departments serving the project.
  3. Regulations of the Office of State Fire Marshal or its equivalent.
  4. Americans with Disabilities Act (ADA).
  5. Applicable editions of NFPA .

- B. Contradictions: Where Codes are contradictory, follow the most stringent, unless otherwise indicated in Plans or Specifications. Architect shall determine which is most stringent.
- C. Codes are a minimum requirement approved by the AHJ, in many cases the Project Documents will exceed the minimum requirements of the codes, Project Documents must be followed.
- D. Inspections and Tests:
  - 1. Inspections and tests required shall be completed by a third party NETA Testing Agency/Contractor. Contractor shall arrange for all required inspections and testing.
  - 2. Contractor shall pay all inspections and testing charges.
  - 3. Notify Architect two (2) business days before tests.
  - 4. Inspections reports and Test Reports shall be provided to the Architect for review and shall be included in the final Record Documents.

#### 1.6. OWNER-FURNISHED EQUIPMENT

- A. All equipment called out in the Specifications or shown on the Drawings as "Owner-Furnished Equipment" or equipment furnished by other Divisions shall be installed and connected as required. Provide rough-ins for all future connections indicated.

#### 1.7. INSTALLATION GENERAL REQUIREMENTS

- A. Furnish, apply, install, connect, erect, clean, and condition manufactured materials and equipment as recommended in manufacturer's printed directions (maintained on job site during installation).
- B. Provide all attachment devices and materials necessary to secure materials together or to other materials.
- C. Make allowance for ample and normal expansion and contraction for all building components and piping systems that are subject to such.
- D. Install materials only when conditions of temperature, moisture, humidity, and conditions of adjacent building components are conducive to achieving the best installation results.
- E. Erect, install, and secure components in a structurally sound and appropriate manner.
- F. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.
- G. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.
- H. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking, or other disfigurement.
- I. Conduct work in a manner to avoid injury or damage to previously placed work. Any work so impaired or damaged shall be replaced at no expense to Owner.
- J. Fabricate and install materials true to line, plumb, and level.
- K. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents, and other imperfections.



- L. Furnish materials in longest practical lengths and largest practical sizes to avoid all unnecessary jointing.
- M. Make all joints secure, tightly fitted, and as inconspicuous as possible by the best accepted practice in joining and fabricating.
- N. Contact Architect for mounting height or position of any unit not specifically indicated or located on Drawings or specified in Specifications.
- O. Job mixed multi-component materials used in the work shall be mixed in such regulated and properly sized batches that material can be used before it begins to "set."
- P. Mixing of a partially "set" batch with another batch of fresh materials will not be accepted and entire batch shall be discarded and removed from site.
- Q. Clean all mixing tools and appliances that can be contaminated prior to mixing of fresh materials.
- R. In addition to the above, refer to each Section of the Specifications for additional installation requirements for the proper completion of all work.

## PART 2 - PRODUCTS

### 2.1. GENERAL

- A. Follow substitution instructions in Front End Documents for any manufacturer not listed in the Project Manual or the drawings that the contractor may want considered for substitution. .
- B. Coordination of general equivalents and substitutions: Where Contract Documents permit selection from several general equivalents, or where substitutions are authorized, coordinate clearance and other interface requirements with electrical and other work.
  - 1. Provide necessary additional items so that selected or substituted item operates equivalent to the basis of design and properly fits in the available space allocated for the basis of design.
  - 2. Provide all features which are standard and specified on the basis of design.
  - 3. Contractor is responsible for assuring that piping, conduit, duct, flue, and other service locations for general equivalents or substitutions do not cause access, service, or operational difficulties any greater than would be encountered with the basis of design. Acceptance by the Architect does not imply acceptance of any deviations from contract documents requirements.
  - 4. Confirm if modifications to electrical, structural or architectural requirements for substituted or general equivalents are needed such as: wire size, conduit size, MCA, MOCP, weight, support, etc. Coordinate with General and Electrical Contractors prior to bid.

## PART 3 – EXECUTION

### 3.1. COORDINATION OF ELECTRICAL INSTALLATION.

- A. Inspection and Preparation:
  - 1. Examine the work interfacing with electrical work, and the conditions under which the work will be performed, and notify the Architect of conditions detrimental to the proper completion of the work.
  - 2. Do not proceed with the work until unsatisfactory conditions have been corrected. Lack of notifying Architect of conditions is in no way cause for change order request.
- B. Layout:

1. Layout the electrical work in conformity with the Contract Drawings, and other Shop Drawings, product data and similar requirements so that the entire electrical plant will perform as an integrated system, properly interfaced with other work, recognizing that portions of the work are shown only in diagrammatic form.
  2. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of the conflict.
  3. Take necessary field measurements to determine space and connection requirements.
  4. Provide sizes and shapes of equipment so the final installation conforms to the intent of the Contract Documents.
- C. Integrate electrical work in ceiling spaces with suspension system, light fixtures and other work so that required performances of each will be achieved.

### 3.2. PRODUCT INSTALLATION

#### A. Manufacturer's Instructions:

1. Except where more stringent requirements are indicated, comply with the product manufacturer's instructions and recommendations.
2. Consult with manufacturer's technical representatives, who are recognized as technical experts, for specific instructions on special project conditions.
3. If a conflict exists, notify the Architect in writing and obtain his instruction before proceeding with the work in question.

#### B. Movement of Equipment:

1. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls and roofs will not be delayed or need to be removed.
2. Otherwise, advise Contractor of opening requirements to be maintained for the subsequent entry of equipment.

#### C. Heavy Equipment:

1. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.
2. Where electrical products to be installed on an existing roof are too heavy to be hand-carried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.

#### D. Return Air Path: Coordinate electrical work in return air plenum to avoid obstructing return air path.

1. Do not make changes in layout which will reduce return air path cross-sectional areas.
2. Report any obstructions by work of other Divisions to Architect.

#### E. Support:

1. Anchor and secure all equipment to the building substrate and structure.

#### F. Clearances:

1. Install conduit and cables:

- a. Straight and true.
  - b. Aligned with other work and with general lines of the building.
  - c. Concealed, where possible, in occupied spaces.
  - d. Out-of-the-way with maximum passageway and headroom remaining in each space.
2. Except as otherwise indicated, arrange electrical services and overhead equipment with a minimum of:
    - a. 7'6" headroom in storage spaces. Do not obstruct windows, doors or other openings.
  3. Give the right-of-way to piping systems required to slope for drainage (over other service lines and ductwork).

### 3.3. PROTECTION OF WORK

- A. All conduit ends, panelboards, motor controls, disconnecting means, and equipment left unconnected shall be capped, plugged or otherwise properly protected to prevent damage or the intrusion of foreign matter.
- B. Any equipment or conduit system found to have been damaged or contaminated shall be replaced or cleaned to the Engineer's satisfaction.

### 3.4. ADJUSTING

- A. Adjust all equipment and system components as shown or as otherwise required to result in intended system operation.
- B. At completion of work, provide written certification that all systems are functioning properly without defects.

### 3.5. START-UP

- A. Assign a Start-Up Coordinator to this project.
- B. The Start-Up Coordinator shall develop detailed start-up procedures, equipment checkout procedure and data forms for recording compliance with contract document performance criteria, and will assist in developing schedules for checkout and Owner acceptance.
- C. The Start-Up Coordinator shall be responsible for maintaining documentation of Start-Up activities until final acceptance of the project.
- D. The documentation shall be kept current by the Start-Up Coordinator and shall be available for inspection at all times. At the time of acceptance of the project, the Start-Up Coordinator shall surrender 3 completed copies of the documentation to the Owner's representative.
  1. Coordinate with the mechanical installation the requirements for the startup of mechanical and plumbing systems:
    - a. All equipment, components, and systems have been set, started-up, and adjusted including checking the following: proper equipment electrical rotation, control connections, factory trained technician startup, etc.
    - b. All electric power connections, disconnects, fuses, circuit breakers, etc. are properly sized and installed.

### 3.6. TRAINING

- A. Refer to Division 1 sections of the specifications regarding requirements of Record Drawings, Operation and Maintenance Manual submittal and systems training.
  - 1. Demonstrate that each system operates properly.
  - 2. Explain the operation of each system to the Owner's Representative.
  - 3. Explain use of O&M manual in operating and maintaining systems.
  - 4. Date, time, and duration of training will be determined by Owner.
  - 5. Training agendas and schedules shall be developed and approved by Owner, Commissioning Authority, Engineer, and Architect prior to training.
  - 6. Document and turn over to owner the training sessions on DVD and placed in O&M Manuals. At the end of all sessions, compile all sessions on a single DVD and turn over to owner as part of the O & M manuals.
- B. For specific systems requiring extended instruction, refer to individual Division 26 sections.

**END OF SECTION 26 0010**

**SECTION 26 0505 - SELECTIVE DEMOLITION FOR ELECTRICAL****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Electrical demolition.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 7000 - Execution and Closeout Requirements: Additional requirements for alterations work.

**PART 2 PRODUCTS****2.1. MATERIALS AND EQUIPMENT**

- A. Materials and equipment for patching and extending work: As specified in individual sections.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify field measurements and circuiting arrangements are as indicated.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents.
- D. Report discrepancies to Architect before disturbing existing installation.
- E. Beginning of demolition means installer accepts existing conditions.

**3.2. PREPARATION**

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Existing Fire Alarm System: Maintain existing system in service . Disable system only to make connections to new devices. Minimize outage duration.
  - 1. Notify Owner before partially or completely disabling system.
  - 2. Notify local fire service.
  - 3. Make notifications at least 24 hours in advance.

**3.3. DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned wiring to source of supply.
- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

#### 3.4. CLEANING AND REPAIR

- A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace broken electrical parts.

**END OF SECTION 26 0505**

**SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Heat shrink tubing.
- E. Oxide inhibiting compound.
- F. Wire pulling lubricant.
- G. Cable ties.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 26 0505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

**1.3. REFERENCE STANDARDS**

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

- H. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- N. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.



- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

#### 1.8. FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

### PART 2 PRODUCTS

#### 2.1. CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Armored cable is not permitted.
- F. Metal-clad cable is not permitted.

#### 2.2. CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- I. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
  2. Control Circuits: 14 AWG.
- K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- L. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  2. Color Coding Method: Integrally colored insulation.
    - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
  3. Color Code:
    - a. 480Y/277 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
      - 4) Neutral/Grounded: Gray.
    - b. 208Y/120 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Neutral/Grounded: White.
    - c. Equipment Ground, All Systems: Green.
    - d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
    - e. For control circuits, comply with manufacturer's recommended color code.

### 2.3. SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
  - 1. Copper Building Wire:
    - a. Cerro Wire LLC: [www.cerrowire.com](http://www.cerrowire.com).
    - b. Encore Wire Corporation: [www.encorewire.com](http://www.encorewire.com).
    - c. Southwire Company: [www.southwire.com](http://www.southwire.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  - 1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

### 2.4. WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
  - 3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors where connectors are required.
  - 4. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

- F. Mechanical Connectors: Provide bolted type or set-screw type.
- G. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

## 2.5. WIRING ACCESSORIES

- A. Electrical Tape:
  - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
  - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
  - 3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
  - 4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
  - 5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### 3.3. INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
  - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
  - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

- G. Install conductors with a minimum of 12 inches of slack at each outlet.
- H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- K. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  - 3. Do not remove conductor strands to facilitate insertion into connector.
  - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
  - 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
  - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
  - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
  - 3. Wet Locations: Use heat shrink tubing.
- M. Insulate ends of spare conductors using vinyl insulating electrical tape.
- N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- O. Identify conductors and cables in accordance with Section 26 0553.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
  - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

**END OF SECTION 26 0519**

**SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground plate electrodes.
- E. Ground enhancement material.
- F. Ground access wells.
- G. Pre-fabricated signal reference grids.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
  - 1. Includes oxide inhibiting compound.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

**1.3. REFERENCE STANDARDS**

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

**1.5. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.



- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Field quality control test reports.
- E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1. GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Bonding and Equipment Grounding:
  - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal air ducts.

E. Pole-Mounted Luminaires: Also comply with Section 26 5600.

## 2.2. GROUNDING AND BONDING COMPONENTS

### A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

### B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:

1. Use insulated copper conductors unless otherwise indicated.

### C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).

- B. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

- C. Identify grounding and bonding system components in accordance with Section 26 0553.

### 3.3. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

- B. Inspect and test in accordance with NETA ATS except Section 4.

- C. Perform inspections and tests listed in NETA ATS, Section 7.13.

**END OF SECTION 26 0526**

**SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- B. Section 26 0533.16 - BOXES: Additional support and attachment requirements for boxes.
- C. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

**1.3. REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 2. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 3. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

**1.5. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Installer's Qualification Statement: Include evidence of compliance with specified requirements.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### 1.6. QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
- E. Installer Qualifications for Field-Welding: As specified in Section 05 5000.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1. SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
  - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
  - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
  - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
  - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
  - 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
  - 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

- b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
  - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
  - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials for Metal Fabricated Supports: Comply with Section 05 5000.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
  - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  - 2. Conduit Clamps: Bolted type unless otherwise indicated.
  - 3. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
    - d. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
  - 1. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
    - d. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
  - 1. Comply with MFMA-4.
  - 2. Channel Material:
    - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
  - 3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
  - 4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
  - 5. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com](http://www.unistrut.com).

- d. Substitutions: See Section 01 6000 - Product Requirements.
  - e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- 1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2 inch diameter.
    - b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
    - c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
    - d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
    - e. Outlet Boxes: 1/4 inch diameter.
    - f. Luminaires: 1/4 inch diameter.
- G. Anchors and Fasteners:
- 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  - 4. Hollow Masonry: Use toggle bolts.
  - 5. Hollow Stud Walls: Use toggle bolts.
  - 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  - 7. Sheet Metal: Use sheet metal screws.
  - 8. Wood: Use wood screws.
  - 9. Plastic and lead anchors are not permitted.
  - 10. Powder-actuated fasteners are permitted only as follows:
    - a. Where approved by Architect.
    - b. Use only threaded studs; do not use pins.
  - 11. Hammer-driven anchors and fasteners are permitted only as follows:
    - a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
    - b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
  - 12. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
  - 13. Manufacturers - Mechanical Anchors:
    - a. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
    - b. ITW Red Head, a division of Illinois Tool Works, Inc: [www.itwredhead.com](http://www.itwredhead.com).

- c. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).
  - d. Simpson Strong-Tie Company Inc: [www.strongtie.com](http://www.strongtie.com).
  - e. Substitutions: See Section 01 6000 - Product Requirements.
14. Manufacturers - Powder-Actuated Fastening Systems:
- a. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - b. ITW Ramset, a division of Illinois Tool Works, Inc: [www.ramset.com](http://www.ramset.com).
  - c. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).
  - d. Simpson Strong-Tie Company Inc: [www.strongtie.com](http://www.strongtie.com).
  - e. Substitutions: See Section 01 6000 - Product Requirements.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Field-Welding (where approved by Architect): Comply with Section 05 5000.
- I. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.



- J. Conduit Support and Attachment: Also comply with Section 26 0533.13.
- K. Box Support and Attachment: Also comply with Section 26 0533.16.
- L. Busway Support and Attachment: Also comply with Section 26 2513.
- M. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.
- N. Secure fasteners according to manufacturer's recommended torque settings.
- O. Remove temporary supports.
- P. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

### 3.3. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION 26 0529**

**SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. Flexible metal conduit (FMC).
- D. Electrical metallic tubing (EMT).
- E. Conduit fittings.
- F. Accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0533.16 - BOXES.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 27 1000 - Structured Cabling: Additional requirements for communications systems conduits.

**1.3. REFERENCE STANDARDS**

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.
- J. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014.

- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- S. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

##### B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

#### 1.5. SUBMITTALS

##### A. See Section 01 3000 - Administrative Requirements for submittals procedures.

##### B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

##### C. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

- D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1. CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- D. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- E. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- G. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
  - 1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
    - b. Where exposed below 20 feet in warehouse areas.
- I. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
  - 1. Maximum Length: 6 feet.
- J. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
  - a. Transformers.
  - b. Motors.

## 2.2. CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Communications Systems Conduits: Also comply with Section 27 1000.
- C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.
- D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
  1. Branch Circuits: 3/4 inch (21 mm) trade size.
  2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
  3. Control Circuits: 3/4 inch (21 mm) trade size.
  4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
  5. Underground, Interior: 3/4 inch (21 mm) trade size.
  6. Underground, Exterior: 3/4 inch (21 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## 2.3. GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
  2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
  3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
  1. Manufacturers:

- a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
  - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
  - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

#### 2.4. INTERMEDIATE METAL CONDUIT (IMC)

##### A. Manufacturers:

1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
4. Substitutions: See Section 01 6000 - Product Requirements.

##### B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

##### C. Fittings:

1. Manufacturers:
  - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
  - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
  - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

#### 2.5. FLEXIBLE METAL CONDUIT (FMC)

##### A. Manufacturers:

1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com).

2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com).
  3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.

## 2.6. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com).
  2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com).
  3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.

## 2.7. ELECTRICAL METALLIC TUBING (EMT)

### A. Manufacturers:

1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
4. Substitutions: See Section 01 6000 - Product Requirements.

### B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

### C. Fittings:

#### 1. Manufacturers:

- a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
- b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
- c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
- d. Substitutions: See Section 01 6000 - Product Requirements.

#### 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

#### 3. Material: Use steel or malleable iron.

- a. Do not use die cast zinc fittings.

#### 4. Connectors and Couplings: Use set-screw type.

- a. Do not use indenter type connectors and couplings.

#### 5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

#### 6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

## 2.8. ACCESSORIES

### A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

### B. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

### C. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

### D. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

## PART 3 EXECUTION

### 3.1. EXAMINATION

#### A. Verify that field measurements are as indicated.



- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal all conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
  - 7. Arrange conduit to provide no more than 150 feet between pull points.
  - 8. Route conduits above water and drain piping where possible.
  - 9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  - 10. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  - 11. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
  - 12. Group parallel conduits in the same area together on a common rack.
- F. Conduit Support:
  - 1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
  - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

G. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
  7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
  9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
  10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  3. Where conduits are subject to earth movement by settlement or frost.
- J. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- K. Provide grounding and bonding in accordance with Section 26 0526.
- L. Identify conduits in accordance with Section 26 0553.
- 3.3. FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
  - B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
  - C. Correct deficiencies and replace damaged or defective conduits.
- 3.4. CLEANING
- A. Clean interior of conduits to remove moisture and foreign matter.
- 3.5. PROTECTION
- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**END OF SECTION 26 0533.13**

**SECTION 26 0533.16 - BOXES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Floor boxes.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0533.13 - Conduit for Electrical Systems:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 2726 - Wiring Devices:
  - 1. Wall plates.
  - 2. Floor box service fittings.
  - 3. Poke-through assemblies.
  - 4. Access floor boxes.
  - 5. Additional requirements for locating boxes for wiring devices.

**1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures and floor boxes.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, and floor boxes.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Keys for Lockable Enclosures: Two of each different key.

## 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.1. BOXES

- A. General Requirements:
  - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
  - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  - 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
  - 4. Use shallow boxes where required by the type of wall construction.
  - 5. Do not use "through-wall" boxes designed for access from both sides of wall.
  - 6. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  - 7. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  - 8. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
  - 9. Minimum Box Size, Unless Otherwise Indicated:
    - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.

- c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
- 10. Wall Plates: Comply with Section 26 2726.
- 11. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
  - b. Hubbell Incorporated; Bell Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com).
  - c. Hubbell Incorporated; RACO Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com).
  - d. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
  - e. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - f. Substitutions: See Section 01 6000 - Product Requirements.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    - a. Indoor Clean, Dry Locations: Type 1, painted steel.
    - b. Outdoor Locations: Type 3R, painted steel.
  - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide hinged-cover enclosures unless otherwise indicated.
    - b. Boxes 6 square feet and Larger: Provide hinged-cover enclosures.
  - 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    - b. Back Panels: Painted steel, removable.
  - 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
  - 6. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Hoffman, a brand of Pentair Technical Products: [www.hoffmanonline.com](http://www.hoffmanonline.com).
    - c. Hubbell Incorporated; Wiegmann Products: [www.hubbell-wiegmann.com](http://www.hubbell-wiegmann.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Floor Boxes:
  - 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
  - 2. Use cast iron floor boxes within slab on grade.
  - 3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
  - 4. Manufacturer: Same as manufacturer of floor box service fittings.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- G. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
  - 2. Unless dimensioned, box locations indicated are approximate.
  - 3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
  - 4. Locate boxes so that wall plates do not span different building finishes.
  - 5. Locate boxes so that wall plates do not cross masonry joints.
  - 6. Install flush-mounted boxes on opposite sides of walls in different stud spaces, boxes shall not be installed back to back.
  - 7. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
  - 8. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Install in sperate stud cavities, if not possible, provide minimum 6 inches horizontal separation unless otherwise indicated.
  - 9. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
  - 10. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.



- a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
11. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
12. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
  - a. Concealed above accessible suspended ceilings.
  - b. Within joists in areas with no ceiling.
  - c. Electrical rooms.
  - d. Mechanical equipment rooms.
- H. Box Supports:
  1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
  4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- I. Install boxes plumb and level.
- J. Flush-Mounted Boxes:
  1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- K. Install boxes as required to preserve insulation integrity.
- L. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

- O. Close unused box openings.
- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- Q. Provide grounding and bonding in accordance with Section 26 0526.
- R. Identify boxes in accordance with Section 26 0553.

3.3. CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4. PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**END OF SECTION 26 0533.16**

**SECTION 26 0533.23 - SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Surface raceway systems.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0533.13 - Conduit for Electrical Systems.
- D. Section 26 0533.16 - BOXES.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 2726 - Wiring Devices: Receptacles.
- G. Section 27 1000 - Structured Cabling: Voice and data jacks.

**1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway; 2015.
- D. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS****A. Coordination:**

1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate rough-in locations of outlet boxes provided under Section 26 0533.16 and conduit provided under Section 26 0533.13 as required for installation of raceways provided under this section.
3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

**B. Sequencing:**

1. Do not install raceways until final surface finishes and painting are complete.
2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

### 1.5. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
  - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.1. RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

### 2.2. SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com](http://www.hubbell.com).
  - 2. MonoSystems, Inc: [www.monosystems.com](http://www.monosystems.com).
  - 3. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- C. Surface Raceway System:
  - 1. Raceway Type: Single channel, painted steel.
  - 2. Length: As required by the plans and conditions..
  - 3. Color: To be selected by Architect.
  - 4. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install raceways plumb and level.
- D. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.
- E. Close unused raceway openings.
- F. Provide grounding and bonding in accordance with Section 26 0526.
- G. Identify raceways in accordance with Section 26 0553.

#### 3.3. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect raceways for damage and defects.
- C. Correct wiring deficiencies and replace damaged or defective raceways.

#### 3.4. CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

#### 3.5. PROTECTION

- A. Protect installed raceways from subsequent construction operations.

### END OF SECTION 26 0533.23

**SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.

**1.2. RELATED REQUIREMENTS**

- A. Section 09 9123 - Interior Painting.
- B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- C. Section 26 2726 - Wiring Devices: Device and wallplate finishes; wallplate markings.
- D. Section 27 1000 - Structured Cabling: Identification for communications cabling and devices.

**1.3. REFERENCE STANDARDS**

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.
- E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
  - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

**1.5. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

#### 1.7. FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

### PART 2 PRODUCTS

#### 2.1. IDENTIFICATION REQUIREMENTS

##### A. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
  - a. At each source and load connection.
  - b. Within boxes when more than one circuit is present.
  - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

##### B. Identification for Raceways:

1. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
  - a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
    - 1) Color Code:
      - (a) Fire Alarm System: Red.
    - 2) Field-Painting: Comply with Section 09 9123 and 09 9113.
    - 3) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.
2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

C. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
  - a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.
    - 1) Fire Alarm System: Red.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
  - a. For exposed boxes in public areas, use only identification labels.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

D. Identification for Devices:

1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
2. Use identification label to identify fire alarm system devices.
3. Use engraved wallplate to identify serving branch circuit for all receptacles.
4. Use engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

2.2. IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:
  - a. Indoor Clean, Dry Locations: Use plastic nameplates.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
  - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:
  - a. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
  - b. Brother International Corporation: [www.brother-usa.com](http://www.brother-usa.com).
  - c. Panduit Corp: [www.panduit.com](http://www.panduit.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.



2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
    - a. Use only for indoor locations.
  3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
  2. Legend:
    - a. System designation where applicable:
      - 1) Fire Alarm System: Identify with text "FIRE ALARM".
    - b. Equipment designation or other approved description.
    - c. Other information as indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height:
    - a. System Designation: 1 inch.
    - b. Equipment Designation: 1/2 inch.
    - c. Other Information: 1/4 inch.
    - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
  5. Color:
    - a. Normal Power System: White text on black background.
    - b. Fire Alarm System: White text on red background.
- D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/4 inch.
  5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/2 inch.

5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
  - a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

## 2.3. WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
2. HellermannTyton: [www.hellermannntyton.com](http://www.hellermannntyton.com).
3. Panduit Corp: [www.panduit.com](http://www.panduit.com).
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

1. Do not use handwritten text.

- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

## 2.4. VOLTAGE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
  - 2. Brimar Industries, Inc: [www.brimar.com](http://www.brimar.com).
  - 3. Seton Identification Products: [www.seton.com](http://www.seton.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
  - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
  - 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
  - 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  - 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- E. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
  - 2. Markers for System Identification:
    - a. Emergency Power System: Text "EMERGENCY".
    - b. Other Systems: Type of service.
- F. Color: Black text on orange background unless otherwise indicated.

## PART 3 EXECUTION

### 3.1. PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Elevated Equipment: Legible from the floor or working platform.
  - 2. Branch Devices: Adjacent to device.

3. Interior Components: Legible from the point of access.
  4. Conduits: Legible from the floor.
  5. Boxes: Outside face of cover.
  6. Conductors and Cables: Legible from the point of access.
  7. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
  - D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing.
  - E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
  - F. Mark all handwritten text, where permitted, to be neat and legible.
- 3.3. FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
  - B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

**END OF SECTION 26 0553**

**SECTION 26 0923 - LIGHTING CONTROL DEVICES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Vacancy sensors.
- B. Daylighting controls.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0533.16 - BOXES.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2726 - Wiring Devices: for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
  - 1. Includes finish requirements for wall controls specified in this section.
  - 2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.
- F. Section 26 5100 - Interior Lighting.

**1.3. REFERENCE STANDARDS**

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
- C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

- J. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
- K. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of vacancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

##### B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

#### 1.5. SUBMITTALS

##### A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

##### B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Vacancy Sensors: Include detailed motion detection coverage range diagrams.

##### C. Shop Drawings:

1. Vacancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

##### D. Field Quality Control Reports.

##### E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

##### F. Operation and Maintenance Data: Include detailed information on device programming and setup.

##### G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

- H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

#### 1.8. FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.9. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all vacancy sensors.
- C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
- D. Provide two year manufacturer warranty for all daylighting controls.

### PART 2 PRODUCTS

#### 2.1. LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- C. Products for Switching of Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

#### 2.2. OCCUPANCY SENSORS

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com](http://www.hubbell.com).
  - 2. Sensor Switch Inc: [www.sensorswitch.com](http://www.sensorswitch.com).
  - 3. Acuity Controls: [www.Acuitybrands.com](http://www.Acuitybrands.com)

4. Eaton (Cooper) Controls: [www.Cooperindustries.com/content/public/en/lighting\\_lighting.html](http://www.Cooperindustries.com/content/public/en/lighting_lighting.html)
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
  - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
  - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
  - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, vacancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Vacancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
13. Isolated Relay for Low Voltage Vacancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
14. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
15. Wireless Sensors:
  - a. RF Range: 30 feet through typical construction materials.



- b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
  - c. Power: Battery-operated with minimum ten-year battery life.
- C. Wall Switch Vacancy Sensors:
  - 1. All Wall Switch Vacancy Sensors:
    - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
    - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
    - d. Operation: Operates as a Vacnacy sensor, manual on, automatic off..
    - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    - f. Provide selectable audible alert to notify occupant of impending load turn-off.
    - g. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
    - h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
  - 2. Passive Infrared (PIR) Wall Switch Vacancy Sensors: Capable of detecting motion within an area of 900 square feet.
  - 3. Passive Infrared/Ultrasonic Dual Technology Wall Switch Vacancy Sensors: Capable of detecting motion within an area of 900 square feet.
- D. Wall Dimmer Vacancy Sensors:
  - 1. General Requirements:
    - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
    - b. Operation: Operates as Vacancy sensor, manual on, automatic off..
    - c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    - d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
    - e. Provide field adjustable dimming preset for occupied state.
    - f. Provide fade-to-off operation to notify occupant of impending load turn-off.

- g. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
    - 2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
  - E. Ceiling Mounted Vacancy Sensors:
    - 1. All Ceiling Mounted Vacancy Sensors:
      - a. Description: Low profile occupancy sensors designed for ceiling installation.
      - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
      - c. Provide field selectable setting for disabling LED motion detector visual indicator.
      - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      - e. Finish: White unless otherwise indicated.
    - 2. Passive Infrared (PIR) Ceiling Mounted Vacancy Sensors:
      - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
    - 3. Ultrasonic Ceiling Mounted Vacancy Sensors:
      - a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      - b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      - c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.
    - 4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
  - F. Directional Occupancy Sensors:
    - 1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
      - a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
      - b. Provide field selectable setting for disabling LED motion detector visual indicator.
      - c. Finish: White unless otherwise indicated.
    - 2. Passive Infrared (PIR) Directional Occupancy Sensors:

- a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
  - b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet at a mounting height of 10 feet.
  - c. High Bay Sensors: Capable of detecting motion within a distance of 50 feet at a mounting height of 30 feet.
3. Passive Infrared/Ultrasonic Dual Technology Directional Vacancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
- G. Power Packs for Low Voltage Vacancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
  2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
  3. Input Supply Voltage: Dual rated for 120/277 V ac.
  4. Load Rating: As required to control the load indicated on drawings.
- H. Power Packs for Wireless Vacancy Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
  2. Input Supply Voltage: Dual rated for 120/277 V ac.
  3. Load Rating: As required to control the load indicated on drawings.
  4. Provide auxiliary contact closure output where indicated.
  5. Rated Life of Relay: One million cycles.

### 2.3. DAYLIGHTING CONTROLS

- A. Manufacturers:
1. Hubbell Control Solutions: [www.hubbell.com/hubbellcontrolsolutions/en/#sle](http://www.hubbell.com/hubbellcontrolsolutions/en/#sle).
  2. Lutron Electronics Company, Inc: [www.lutron.com](http://www.lutron.com).
  3. Acuity Controls:: [www.Acuitybrands.com](http://www.Acuitybrands.com).
  4. Eaton (Cooper) Controls: [www.Cooperindustries.com/content/public/en/lighting.html](http://www.Cooperindustries.com/content/public/en/lighting.html)
  5. WattStopper: [www.legrtand.us/wattstopper.aspx](http://www.legrtand.us/wattstopper.aspx).
  6. Substitutions: See Section 01 6000 - Product Requirements.
  7. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
- C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.

1. Sensor Type: Filtered silicon photo diode.
  2. Sensor Range:
    - a. Indoor Photo Sensors: 5 to 100 footcandles.
    - b. Outdoor Photo Sensors: 5 to 250 footcandles.
    - c. Atrium Photo Sensors: 200 to 2,500 footcandles.
    - d. Skylight Photo Sensors: 1,000 to 6,000 footcandles.
    - e. Open Loop Photo Sensors: 3 to 6,000 footcandles.
  3. Finish: White unless otherwise indicated.
  4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
- D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming driver, for direct continuous dimming of up to 50 drivers.
- E. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
  2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
  3. Control Capability:
    - a. Single Zone Switching Modules: Capable of controlling one programmable channel.
    - b. Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.
- F. Daylighting Control Switching Modules for Wireless Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
  2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
  3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
  4. Control Capability: Capable of controlling one programmable channel.
  5. Input Supply Voltage: Dual rated for 120/277 V ac.
  6. Load Rating: As required to control the load indicated on drawings.
  7. Provide auxiliary contact closure output where indicated.
  8. Rated Life of Relay: One million cycles.
- G. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified drivers, for both continuous dimming of

compatible drivers and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
2. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
3. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
4. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
5. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.
6. Output Voltage: Compatible with specified dimming ballasts.

H. Daylighting Control Dimming Modules for Wireless Sensors:

1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible drivers in response to changes in measured light levels according to selected settings.
2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
4. Control Capability: Capable of controlling up to 32 drivers with up to two separately programmable daylighting zones.

I. Power Packs for Low Voltage Daylighting Control Modules:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
2. Input Supply Voltage: Dual rated for 120/277 V ac.
3. Load Ratings: As required to control the load indicated on drawings.
4. Load Ratings:

J. Accessories:

1. Where indicated, provide compatible accessory wall switches for manual override control.
2. Where indicated, provide compatible accessory wireless controls for manual override control.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.3. INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switch Vacancy Sensors: 48 inches above finished floor.
  - 2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
  - 3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
- G. Provide required supports in accordance with Section 26 0529.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Identify lighting control devices in accordance with Section 26 0553.

## J. Vacancy Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

## K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

## L. Daylighting Control Photo Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

## M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

## N. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

## O. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

## 3.4. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each lighting control device for damage and defects.
- C. Test vacancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

## 3.5. ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

- B. Adjust vacancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.
- E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.
- F. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

### 3.6. CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### 3.7. CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
  - 4. Location: At project site.

**END OF SECTION 26 0923**



**SECTION 26 2726 - WIRING DEVICES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Wall switches.
- B. Wall dimmers.
- C. Fan speed controllers.
- D. Receptacles.
- E. Wall plates.
- F. Floor box service fittings.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0533.16 - BOXES.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including Vacancy Sensors.
- F. Section 26 2913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

**1.3. REFERENCE STANDARDS**

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

- I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.
- M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Samples: One for each type and color of device and wall plate specified.
- D. Operation and Maintenance Data:
  - 1. Wall Dimmers: Include information on operation and setting of presets.
  - 2. GFCI Receptacles: Include information on status indicators.
- E. Project Record Documents: Record actual installed locations of wiring devices.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
- B. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
- C. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us)
- D. Substitutions: See Section 01 6000 - Product Requirements.
- E. Source Limitations: Where possible, provide products for each type of wiring device produced by a single manufacturer and obtained from a single supplier.
- F. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

#### 2.2. WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. Unless noted otherwise, do not use combination switch/receptacle devices.
- H. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

#### 2.3. WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices Installed in Finished Spaces: Consult with Architect during shop drawing phase for selection of color with matching nylon wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

- D. Flush Floor Box Service Fittings: White wiring devices with aluminum cover and ring/flange.

#### 2.4. ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes:

#### 2.5. WALL SWITCHES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com](http://www.hubbell.com).
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- D. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

#### 2.6. WALL DIMMERS

- A. Manufacturers:
  - 1. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 2. Lutron Electronics Company, Inc; Maestro Series: [www.lutron.com](http://www.lutron.com).
  - 3. Eaton (Copper) :  
[http://www.cooperindustries.com/content/public/en/wiring\\_devices/products/lighting\\_controls/dimmers.html](http://www.cooperindustries.com/content/public/en/wiring_devices/products/lighting_controls/dimmers.html) :
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Control: Slide control type with separate on/off switch.

- D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

## 2.7. FAN SPEED CONTROLLERS

### A. Manufacturers:

- 1. Provided with Fan by manufacturer. Specified and furnished in Division 23, installed by Division 26..

## 2.8. RECEPTACLES

### A. Manufacturers:

- 1. Hubbell Incorporated: [www.hubbell.com/wiringdevice-kellems/en](http://www.hubbell.com/wiringdevice-kellems/en).
- 2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
- 3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/passandseymour.aspx](http://www.legrand.us/passandseymour.aspx).
- 4. Substitutions: See Section 01 6000 - Product Requirements.
- 5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

### B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

- 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
- 2. NEMA configurations specified are according to NEMA WD 6.

### C. Convenience Receptacles:

- 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
- 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- 3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
- 4. USB/Duplex Receptacle: Industrial specification grade, 20A, 125V, NEMA 5-20R; duplex with Two USB charging ports. Overall 3.1A USB charging capability.
- 5. USB Charging Station Receptacle: Industrial specification grade, 125V, Four USB charging ports. Overall 4.2A USB charging capability.

### D. GFCI Receptacles:

- 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
  - a. Provide test and reset buttons of same color as device.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
  4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
- E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
    - a. Combination duplex receptacle with USB charging capacity of two two-port Devices of 2.1 A each, minimum.
- F. Clock Hanger Receptacles: Single, 15A, 125V, NEMA 5-15R.
- 2.9. WALL PLATES
- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell.com/wiringdevice-kellems/en](http://www.hubbell.com/wiringdevice-kellems/en).
  2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/passandseymour.aspx](http://www.legrand.us/passandseymour.aspx).
  4. Substitutions: See Section 01 6000 - Product Requirements.
  5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  2. Size: Standard.
  3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

## 2.10. FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell.com/wiringdevice-kellems/en](http://www.hubbell.com/wiringdevice-kellems/en).
  2. Thomas & Betts Corporation: <http://www.tnb.com/pub/en/node/10>.
  3. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us/wire-cable-management/floor-boxes.aspx](http://www.legrand.us/wire-cable-management/floor-boxes.aspx).

- B. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.
- C. Flush Floor Service Fittings:
  - 1. Dual Service Flush Combination Outlets:
    - a. Cover: Rectangular.
    - b. Configuration:
      - 1) Power: Two standard convenience duplex receptacle(s) with duplex flap opening(s).
      - 2) Communications: \_\_\_\_\_.
      - 3) Voice and Data Jacks: Provided by others.
  - 2. Accessories:
    - a. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that core drilled holes for poke-through assemblies are in proper locations.
- H. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.3. INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights to top of box: Unless otherwise indicated, as follows:
    - a. Wall Switches: 48 inches above finished floor.
    - b. Wall Dimmers: 48 inches above finished floor.
    - c. Fan Speed Controllers: 48 inches above finished floor.
    - d. Receptacles: 18 inches above finished floor or 6 inches above counter back splash if verticle or 4 inches (100 mm) above counter backsplas if horizontal.
  2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
  5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
- I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- K. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- L. Install wall switches with OFF position down.
- M. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- N. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.



- P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- R. Identify wiring devices in accordance with Section 26 0553.

#### 3.4. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
- C. Inspect each wiring device for damage and defects.
- D. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- E. Test each receptacle to verify operation and proper polarity.
- F. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- G. Correct wiring deficiencies and replace damaged or defective wiring devices.

#### 3.5. ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

#### 3.6. CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

**END OF SECTION 26 2726**

**SECTION 26 2913 - ENCLOSED CONTROLLERS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
  - 1. Manual motor starters.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

**1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
  - 3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
  - 4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

**1.5. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of enclosed controllers and adjacent equipment with all required clearances indicated.
  - 2. Include wiring diagrams showing all factory and field connections.
  - 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  - 4. Include documentation of listed series ratings upon request.
  - 5. Include documentation demonstrating selective coordination upon request.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Field Quality Control Test Reports.
- F. Project Record Documents: Record actual installed locations of controllers and final equipment settings.
  - 1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
  - 2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Electronic Trip Circuit Breakers: Provide one portable test set.
  - 3. Indicating Lights: Two of each different type.
  - 4. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

### 1.8. FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

## PART 2 PRODUCTS

### 2.1. MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer Product: [www.eaton.com](http://www.eaton.com).
- B. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- C. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- D. Substitutions: See Section 01 6000 - Product Requirements.
- E. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

### 2.2. ENCLOSED CONTROLLERS

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Conductor Terminations: Suitable for use with the conductors to be installed.
- E. Enclosures:
  - 1. Comply with NEMA ICS 6.
  - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
  - 3. Finish: Manufacturer's standard unless otherwise indicated.
- F. Manual Motor Starters:
  - 1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
  - 2. Configuration: Non-reversing unless otherwise indicated.

3. Fractional-Horsepower Manual Motor Starters:
  - a. Furnish with toggle operator.
  - b. Overload Relays: Bimetallic or melting alloy thermal type.
  - c. Provide means for locking operator in the OFF position.
  - d. Furnish Red ON indicating light where not within sight of equipment.
4. Integral-Horsepower Manual Motor Starters:
  - a. Furnish with toggle or pushbutton operator.
  - b. Overload Relays: Bimetallic or melting alloy thermal type.
  - c. Provide means for locking operator in the OFF position.
  - d. Furnish Red ON indicating light where not within sight of equipment.
  - e. Provide auxiliary contact where indicated; normally open (NO) or normally closed (NC) as indicated or as required.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed controllers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 26 0526.
- G. Install all field-installed devices, components, and accessories.
- H. Identify enclosed controllers in accordance with Section 26 0553.

#### 3.3. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
- D. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

#### 3.4. ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

#### 3.5. CLEANING

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

#### 3.6. CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

#### 3.7. PROTECTION

- A. Protect installed enclosed controllers from subsequent construction operations.

**END OF SECTION 26 2913**

**SECTION 26 5100 - INTERIOR LIGHTING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Drivers.
- E. Accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0529 - Hangers and Supports for Electrical Systems.
- B. Section 26 0533.16 - BOXES.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
- E. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

**1.3. REFERENCE STANDARDS**

- A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- B. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.
- H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- J. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- L. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

- 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
- 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
- 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
- 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### 1.5. SUBMITTALS

##### A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

##### B. Shop Drawings:

- 1. Indicate dimensions and components for each luminaire.
- 2. Provide photometric calculations where luminaires are proposed for substitution upon request.

##### C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

##### 1. LED Luminaires:

- a. Include estimated useful life, calculated based on IES LM-80 test data.
- b. Include IES LM-79 test report upon request.
- 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
- 3. LED's: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

##### D. Samples:



1. Provide one sample(s) of each specified luminaire where indicated.
  2. Provide one sample(s) of each luminaire proposed for substitution upon request.
  3. Provide one sample(s) of each product finish illustrating color and texture upon request.
- E. Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.
- F. Field quality control reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
  3. Extra LED drivers: Ten percent of total quantity installed for each type of driver, but not less than two of each type..
- J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

#### 1.6. QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

#### 1.8. FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.9. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

- B. Provide five year manufacturer warranty for LED luminaires, including drivers.
- C. Provide five year pro-rata warranty for batteries for emergency lighting units.
- D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

## PART 2 PRODUCTS

### 2.1. MANUFACTURERS - LUMINAIRES

- A. Furnish products from one of the Manufacturers listed in the luminaire schedule found on the drawings..
- B. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..

### 2.2. LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..

### 2.3. LUMINAIRES

- A. Manufacturers:
  - 1. Acceptable Manufacturers for each type of luminaire are listed on the luminaire schedule on the drawings..
  - 2. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide complete luminaires including LED's, reflectors, lenses, drivers, housings and other components required to position, energize and protect the light source and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

## I. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

## 2.4. EMERGENCY LIGHTING UNITS

## A. Manufacturers:

1. Acceptable Manufacturers for each type of luminaire are listed on the luminaire schedule on the drawings..
2. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..

## B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

## C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

## D. Battery:

1. Sealed maintenance-free lead calcium unless otherwise indicated.
2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

## E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

## F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

## G. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

## 2.5. EXIT SIGNS

## A. Manufacturers - Powered and Self-Luminous Signs:

1. Acceptable Manufacturers for each type of luminaire are listed on the luminaire schedule on the drawings..
2. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..

## B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single or double as indicated or as required for the installed location.

2. Directional Arrows: As indicated or as required for the installed location.

C. Self-Powered Exit Signs:

1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
4. Provide low-voltage disconnect to prevent battery damage from deep discharge.

D. Accessories:

1. Provide compatible accessory high impact polycarbonate vandal shields for exit signs located in Gymnasiums and other area's of potential abuse.

## 2.6. DRIVERS

A. Manufacturers:

1. Philips Lighting Electronics/Advance; \_\_\_\_\_: [www.advance.philips.com](http://www.advance.philips.com).

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
  - a. Wall Dimmers: See Section 26 2726.
  - b. Daylighting Controls: See Section 26 0923.

## 2.7. ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.

- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.3. INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
  - 1. Do not use ceiling tiles to bear weight of luminaires.
  - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
  - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
  - 4. Secure pendant-mounted luminaires to building structure.
  - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  - 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
  - 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Suspended Luminaires:
  - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
  4. Install canopies tight to mounting surface.
  5. Unless otherwise indicated, support pendants from swivel hangers.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- M. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- N. Install lamps in each luminaire.
- 3.4. FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
  - B. Inspect each product for damage and defects.
  - C. Operate each luminaire after installation and connection to verify proper operation.
  - D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
  - E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.
- 3.5. ADJUSTING
- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
  - B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
  - C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6. CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7. CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8. PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

**END OF SECTION 26 5100**

**SECTION 27 1000 - STRUCTURED CABLING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Communications system design requirements.
- B. Communications pathways.
- C. Copper cable and terminations.
- D. Communications identification.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0533.13 - Conduit for Electrical Systems.
- D. Section 26 0533.16 - BOXES.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products.

**1.3. REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide; current edition.
- B. ICEA S-90-661 - Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables (With or Without An Overall Shield) For Use in General Purpose and LAN Communications Wiring Systems Technical Requirements; 2012.
- C. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2018.
- F. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009c, with Addendum (2016).
- G. TIA-569 - Telecommunications Pathways and Spaces; 2015d, with Addendum (2016).
- H. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2017c.
- I. UL 444 - Communications Cables; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:



1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Evidence of qualifications for installer.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

#### 1.6. DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep stored products clean and dry.

#### 1.7. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 2 year period after Date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Cabling and Equipment:

#### 2.2. SYSTEM DESIGN

- A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
  1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
  2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
  3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
  4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

- B. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

## 2.3. PATHWAYS

- A. Conduit: As specified in Section 26 0533.13; provide pull cords in all conduit.

## 2.4. COPPER CABLE AND TERMINATIONS

### A. Manufacturers:

1. CommScope.
2. General Cable Technologies Corporation.
3. Siemon Company.
4. \_\_\_\_\_.
5. Substitutions: See Section 01 6000 - Product Requirements.

### B. Copper Horizontal Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications:
  - a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
  - b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
  - c. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
5. Cable Jacket Color - Voice and Data Cable: Blue.
6. Product(s):
  - a. CommScope; SYSTIMAX Twisted Pair Cables; GigaSPEED XL Category 6 U/UTP Cable: [www.commscope.com/#sle](http://www.commscope.com/#sle).
  - b. General Cable Technologies Corporation; GenSPEED Cables: [www.generalcable.com/#sle](http://www.generalcable.com/#sle).
  - c. METZ CONNECT USA Inc; P|Cabling Products: [www.metz-connect.com/#sle](http://www.metz-connect.com/#sle).

## 2.5. IDENTIFICATION PRODUCTS

- A. Comply with TIA-606.

## PART 3 EXECUTION

### 3.1. INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

- B. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

### 3.2. INSTALLATION OF PATHWAYS

- A. Install pathways with the following minimum clearances:
  - 1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
  - 2. 12 inches from power conduits and cables and panelboards.
  - 3. 5 inches from fluorescent and high frequency lighting fixtures.
  - 4. 6 inches from flues, hot water pipes, and steam pipes.
- B. Conduit, in Addition to Requirements of Section 26 0533.13:
  - 1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
  - 2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
  - 3. Arrange conduit to provide no more than 100 feet between pull points.
  - 4. Do not use conduit bodies.
- C. Outlet Boxes:
  - 1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.
    - a. Mounting Heights: Unless otherwise indicated, as follows:
      - 1) Telephone and Data Outlets: 18 inches above finished floor.
    - b. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
    - c. Locate outlet boxes so that wall plate does not span different building finishes.
    - d. Locate outlet boxes so that wall plate does not cross masonry joints.

### 3.3. INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling:
  - 1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
  - 2. Do not over-cinch or crush cables.
  - 3. Do not exceed manufacturer's recommended cable pull tension.
  - 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
- B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
  - 1. At Distribution Frames: 120 inches.

2. At Outlets - Copper: 12 inches.

C. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
3. Use T568B wiring configuration.

D. Identification:

1. Use wire and cable markers to identify cables at each end.

3.4. FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Comply with inspection and testing requirements of specified installation standards.
- C. Visual Inspection:
  1. Inspect cable jackets for certification markings.
  2. Inspect cable terminations for color coded labels of proper type.
  3. Inspect outlet plates and patch panels for complete labels.

**END OF SECTION 27 1000**

**SECTION 27 5129.13 - RESCUE ASSISTANCE SIGNAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Area of refuge/rescue assistance emergency communication system and associated call stations, control stations, and accessories.
  - 1. Includes area of refuge/rescue assistance signage.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0533.13 - Conduit for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

**1.3. 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 (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 72 - National Fire Alarm and Signaling Code; 2016.
- G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for area of refuge/rescue assistance system components.
  - 2. Coordinate the work with other installers to provide communication lines required for control station timed automatic connection to designated constantly attended monitoring location.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install call stations and control station(s) until final surface finishes and painting are complete.

1.5. SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams.
- D. Design Data: Include standby battery calculations.
- E. Evidence of qualifications for installer.
- F. Evidence of qualifications for maintenance contractor (if different entity from installer).
- G. Specimen Warranty: Submit sample of manufacturer's warranty.
- H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- I. Manufacturer's certification that products meet or exceed specified requirements.
- J. Field quality control test reports.
- K. Operation and Maintenance Data: Include detailed information on system operation, equipment setup, replacement parts, and recommended maintenance procedures and intervals.
  1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- L. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- M. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

1.6. QUALITY ASSURANCE

- A. Comply with the following:
  1. ADA Standards.
  2. ICC (IBC) (International Building Code).
  3. NFPA 70 (National Electrical Code).
  4. NFPA 72 (National Fire Alarm and Signaling Code).
  5. NFPA 101 (Life Safety Code).

6. The requirements of the State Fire Marshal.
  7. The requirements of the local authorities having jurisdiction.
  8. Applicable TIA/EIA standards.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
  - C. Manufacturer Qualifications: Company engaged in manufacturing the products specified in this section with minimum three years documented experience.
  - D. Installer Qualifications: Company with minimum three years documented experience with similar area of refuge/rescue assistance systems and providing contract maintenance service as a regular part of their business; manufacturer's authorized installer.
    1. Contract maintenance office located within 200 miles of project site.
  - E. Maintenance Contractor Qualifications: Same entity as installer.
  - F. Products: Listed, classified, and labeled as suitable for the purpose intended.
  - G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- 1.7. DELIVERY, STORAGE, AND HANDLING
- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
  - B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.
- 1.8. FIELD CONDITIONS
- A. Maintain field conditions within manufacturer's required service conditions during and after installation.
- 1.9. WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
  - B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

## PART 2 PRODUCTS

### 2.1. MANUFACTURERS

- A. Area of Refuge/Rescue Assistance Communication System:
  1. Cornell Communications: [www.cornell.com](http://www.cornell.com).
  2. Housing Devices, Inc: [www.housingdevices.com](http://www.housingdevices.com).
  3. Rath Microtech: [www.area-of-refuge.com/](http://www.area-of-refuge.com/).
- B. Substitutions: See Section 01 6000 - Product Requirements.

- C. Source Limitations: Furnish system components and accessories produced by a single manufacturer and obtained from a single supplier.

## 2.2. AREA OF REFUGE/RESCUE ASSISTANCE COMMUNICATION SYSTEM

- A. Provide new area of refuge/rescue assistance communication system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Description:
  - 1. Call Stations: Located at each designated area of refuge/rescue assistance as indicated on drawings, unless otherwise directed by authorities having jurisdiction.
  - 2. Master Control Station: New, located as indicated on drawings, unless otherwise directed by authorities having jurisdiction.
  - 3. Provide secondary control station(s) located as indicated on drawings.
  - 4. System battery backup is required.
  - 5. Timed automatic connection to designated constantly attended monitoring location is required.
  - 6. Interface with Other Equipment:
- C. System Operation:
  - 1. When a call for assistance is initiated at call station:
    - a. Provide audible and visual notification at call station to confirm that call has been placed.
    - b. Provide audible and visual notification at control station(s) that call has been placed and annunciate the location of the call station/zone that initiated a call.
    - c. Maintain visual notification of each call location at control station(s) until manually reset by control station operator.
    - d. Maintain audible notification at control station(s) that call(s) have been placed until call is acknowledged by control station operator.
    - e. Maintain visual notification at call station until manually reset by control station operator.
  - 2. When a call for assistance is acknowledged at control station:
    - a. Provide visual notification at control station that call has been acknowledged.
    - b. Provide visual notification at call station that call has been received.
    - c. Establish two-way voice communication between call station and control station.
  - 3. When a call has not been acknowledged during a programmed time delay to allow for local response, automatically initiate call to listed remote monitoring station under contract with facility and establish two-way voice communication.
- D. Call Station(s):
  - 1. Suitable for the environment where installed.
  - 2. Provides means to initiate call for assistance.
  - 3. Provides for distinct audible and visual notification to confirm that call has been placed and for distinct visual notification that call has been acknowledged.



4. Following initial call for assistance, provides for hands-free two-way communication with control station(s).
- E. Control Station(s):
1. Vandal resistant, with tamper proof hardware.
  2. Suitable for the environment where installed.
  3. Mounting: As indicated on drawings.
  4. Provides visual notification that system is operational.
  5. Provides for distinct audible and visual notification of calls with annunciation of call station/zone locations.
  6. Provides for two-way communication with selected call stations.
  7. Provides for supervision of system wiring and provides distinct audible and visual notification of faults.
  8. Audible Notification Sound Level: Not less than 90 dB.
- F. Accessories:
1. Provide components as indicated or as required for a complete operating system.
  2. Wiring: Provide manufacturer's recommended cables as indicated or as required for connections between system components, and in accordance with wiring methods indicated.
  3. Signage:
    - a. Self-Powered Illuminated Signs: Upon interruption of normal power source, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
    - b. Call Station Instruction Signs: Raised character and Braille instructions complying with ADA Standards.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that characteristics of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Mounting Heights:

1. Call Stations: As indicated on drawings.
2. Control Stations: As indicated on drawings.

D. Wiring Method:

1. Use 2-hour fire-rated circuit integrity (CI) cable or 2-hour fire-rated mineral-insulated, metal-sheathed (MI) cable in accordance with NFPA 72 Level 2/Level 3 pathway survivability requirements.
2. Use listed plenum rated cables in spaces used for environmental air.
3. Install wiring in conduit where required for rough-in, where required by authorities having jurisdiction, and where exposed to damage.
4. Conduit: Comply with Section 26 0533.13.
5. Conceal all cables unless specifically indicated to be exposed.
6. Cables in the following areas may be exposed, unless otherwise indicated:
  - a. Equipment closets.
  - b. Within joists in areas with no ceiling.
7. Route exposed cables parallel or perpendicular to building structural members and surfaces.

E. Provide grounding and bonding in accordance with Section 26 0526.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

G. Identify system wiring and components in accordance with Section 26 0553.

H. Identify zones at control station(s) to indicate call station locations.

I. Provide required instructional signage at each call station.

3.3. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's field reports with submittals.

C. Test to verify wiring is free of shorts and grounds.

D. Prepare and start system in accordance with manufacturer's instructions.

E. Test system for proper operation.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

### 3.4. CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### 3.5. CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

### 3.6. PROTECTION

- A. Protect installed system components from subsequent construction operations.

### 3.7. MAINTENANCE

- A. See Section 01 7900 - Demonstration and Training, for additional requirements relating to maintenance service.
- B. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of area of refuge/rescue assistance system for one year from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.
- D. Provide trouble call-back service upon notification by Owner:
  - 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  - 2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

## END OF SECTION 27 5129.13

**SECTION 28 4600 - FIRE DETECTION AND ALARM****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.
- B. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

**1.3. REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code; 2016.
- F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Drawings must be prepared as DXF-format CAD drawings.
  - 1. Architect will provide CAD floor plan drawings for Contractor's use upon Contractor's completion of Waiver of Liability Agreement form.
- C. Evidence of designer qualifications. Design must be completed by a NICET level IV designer, minimum.
- D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - 1. Copy (if any) of list of data required by authority having jurisdiction.
  - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
  - 4. System zone boundaries and interfaces to fire safety systems.

5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
  7. List of all devices on each signaling line circuit, with spare capacity indicated.
  8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
  9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
  11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
  12. Certification by Contractor that the system design complies with Contract Documents.
- E. Evidence of installer qualifications. Installer must hold a NICET level III certificate, minimum.
- F. Evidence of instructor qualifications; training lesson plan outline.
- G. Evidence of maintenance contractor qualifications, if different from installer.
- H. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
  2. Submit documentation of satisfactory inspections and tests.
  3. Submit NFPA 72 "Inspection and Test Form," filled out.
- I. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
  2. Complete set of specified design documents, as approved by authority having jurisdiction.
  3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  5. List of recommended spare parts, tools, and instruments for testing.
  6. Replacement parts list with current prices, and source of supply.
  7. Detailed troubleshooting guide and large scale input/output matrix.
  8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
  9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

- J. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
  - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
  - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- K. Closeout Documents:
  - 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
  - 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
  - 3. Certificate of Occupancy.
- L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
  - 3. In addition to the items in quantities indicated in PART 2, furnish the following:
    - a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
    - b. One copy, on CD-ROM, of all software not resident in read-only-memory.
    - c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

#### 1.5. QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
- B. Designer Qualifications: NICET Level IV (4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- C. Installer Qualifications: Installer with a minimum NICET Level III (3) and three years experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
  - 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
  - 2. Installer Personnel: At least 3 years of experience installing fire alarm systems.

3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
  4. Contract maintenance office located within 50 miles of project site.
  5. Certified in Illinois as fire alarm installer.
- D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.6. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Existing fire alarm system is Siemens FireFinder XL. Verify existing configuration.
- B. Initiating Devices and Notification Appliances:
  1. All devices and equipment added to the existing fire alarm system shall be 100% compatible with the existing system. All new devices and equipment shall be U.L. listed and shall conform to NFPA 72.
  2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

#### 2.2. EXISTING FIRE ALARM SYSTEM

- A. All devices and equipment added to the existing fire alarm system shall be 100% compatible with the existing system. All new devices and equipment shall be U.L. listed and shall conform to NFPA 72.
- B. All new wiring shall be 100% compatible with the existing fire alarm system and shall be as directed by the manufacturer of the existing fire alarm system. The Electrical Contractor is to provide all fire alarm cable under this contract.
- C. Provide hardware and programming modifications required to the existing alarm control panel and associated accessories to expand the existing system as indicated on the drawings. All modifications shall be complete by the manufacturer's authorized technician.
- D. All wiring shall be verified with the fire alarm equipment supplier as to quantity, size, routing, conduit, junction box requirements, etc.

- E. New visual alarm devices shall be 100% compatible with the existing fire alarm control panel; shall comply with ADA requirements; shall be listed and labeled per U.L. standard 1971; 15/75 cd. type strobe, unless otherwise noted. Surface mount devices at 80" above finished floor or at 6" below ceiling, whichever is lower. Provide associated back box and rough-in to above accessible ceiling space.
- F. New booster power supply (BPS) shall be 100% compatible with the existing fire alarm control panel. Provide BPS unit(s) if existing control panel does not have capacity for additional alarm indicating devices. BPS shall be a single unit or multiple units as required to meet the specified requirements. BPS unit shall be housed in an enclosure with lockable door. BPS shall be equipped to allow activation from an existing notification appliance circuit. BPS unit shall provide 4 amps of notification appliance power distributed between two appliance circuits. BPS unit shall operate from a 120 VAC input and be equipped with a battery back up with associated battery charger. BPS shall be supervised for ground fault, overcurrent, open circuits and low battery conditions. Occurrence of any of these conditions shall create a trouble signal on the fire alarm control panel. BPS shall be U.L. listed and labeled as a fire alarm accessory for use with U.L. listed fire alarm control panel.
- G. Fire alarm system modifications and expansion shall be installed and fully tested under the supervision of the manufacturer's specifications and the appropriate NFPA requirements. Reports of all testing during the installation shall be submitted to the Owner and Engineer upon request.
- H. Before requesting final approval of tech installation, the installing contractor shall furnish a written statement to the effect that the system has been installed and tested in accordance with the manufacturer's specifications and the appropriate NFPA requirements.
- I. Provide demonstration of the modified fire alarm systems to the Owner. Perform all the functions specified.
- J. Submit a certificate of completion per NFPA 72.

## 2.3. EXISTING COMPONENTS

- A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.
- B. Clearly label components that are "Not In Service."
- C. Remove unused existing components and materials from site and dispose of properly.

## 2.4. COMPONENTS

- A. General:
  - 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
  - 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

## PART 3 EXECUTION

### 3.1. INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.



- B. Install all cabling in conduit.
- C. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- D. Obtain Owner's approval of locations of devices, before installation.
- E. Install instruction cards and labels.

### 3.2. INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

### 3.3. CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
  - 1. Be prepared to conduct any of the required tests.
  - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
  - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
  - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
  - 5. Repeat demonstration until successful.
- B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
  - 1. Specified diagnostic period without malfunction has been completed.
  - 2. Approved operating and maintenance data has been delivered.
  - 3. Spare parts, extra materials, and tools have been delivered.
  - 4. All aspects of operation have been demonstrated to Owner.
  - 5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
  - 6. Occupancy permit has been granted.

7. Specified pre-closeout instruction is complete.

C. Perform post-occupancy instruction within 3 months after Substantial Completion.

#### 3.4. MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

D. Comply with Owner's requirements for access to facility and security.

**END OF SECTION 28 4600**