

**PROJECT MANUAL  
FOR**

**ROMEVILLE CAMPUS  
ADDITIONS AND REMODELING**

**OWNER**

JOIET JUNIOR COLLEGE  
1215 HOUBOLT ROAD  
JOLIET, IL 60431

**ARCHITECT / ENGINEER**

KLUBER, INC.  
10 S. SHUMWAY AVENUE  
BATAVIA, ILLINOIS 60510



**SECTION 00 01 01  
PROJECT TITLE PAGE**

**PROJECT MANUAL**

**FOR**

**ROMEOVILLE CAMPUS ADDITIONS AND REMODELING  
1125 WEST 135TH STREET  
ROMEOVILLE, IL 60446**

**OWNER**

**JOLIET JUNIOR COLLEGE  
1215 HOUBOLT ROAD  
JOLIET, IL 60431**

**ARCHITECT/ENGINEER**

**KLUBER ARCHITECTS + ENGINEERS  
10 S. SHUMWAY AVE.  
BATAVIA, ILLINOIS 60510**

**END OF DOCUMENT**

**SECTION 00 01 07  
SEALS PAGE**

**1.01 DESIGN PROFESSIONALS' SEALS**

A. ARCHITECT

B. STRUCTURAL ENGINEER

C. MECHANICAL ENGINEER

D. ELECTRICAL ENGINEER

**END OF DOCUMENT**

**SECTION 00 01 10  
TABLE OF CONTENTS**

<b>PROCUREMENT AND CONTRACTING REQUIREMENTS</b>	<b>PAGES</b>
<b>Introductory Information</b>	
00 01 01      Project Title Page	1
00 01 07      Seals Page	1
00 01 10      Table of Contents	4
00 01 15      Drawing Index	3
<b>Bidding Requirements</b>	
00 31 13      Preliminary Schedule	1
<b>SPECIFICATIONS</b>	<b>PAGES</b>
<b>Division 01 -- General Requirements</b>	
01 10 00      Summary	3
01 21 00      Allowances	1
01 23 00      Alternates	1
01 30 00      Administrative Requirements (1 page attachment)	6
01 40 00      Quality Requirements	7
01 41 00      Regulatory Requirements	2
01 42 00      References	5
01 50 00      Temporary Facilities and Controls	3
01 60 00      Product Requirements (1 page attachment)	4
01 61 16      Volatile Organic Compound (VOC) Content Restrictions	1
01 70 00      Execution and Closeout Requirements	9
01 77 00      Closeout Procedures	2
01 78 00      Closeout Submittals	4
01 79 00      Demonstration and Training	3
<b>Division 02 -- Existing Conditions</b>	
02 41 00      Demolition	5
<b>Division 03 -- Concrete</b>	
03 10 00      Concrete Forming and Accessories	3
03 20 00      Concrete Reinforcing	2

03 24 16	Synthetic Macro Fiber Reinforcement	3
03 30 00	Cast-in-Place Concrete	8
<b>Division 04 -- Masonry</b>		
04 20 00	Unit Masonry	12
04 72 00	Cast Stone Masonry	5
<b>Division 05 -- Metals</b>		
05 12 00	Structural Steel Framing	4
05 31 00	Steel Decking	3
05 50 00	Metal Fabrications	5
<b>Division 06 -- Wood, Plastics, and Composites</b>		
06 10 00	Rough Carpentry	5
06 41 00	Architectural Wood Casework	7
<b>Division 07 -- Thermal and Moisture Protection</b>		
07 21 00	Thermal Insulation	4
07 25 00	Weather Barriers	4
07 53 00	Elastomeric Membrane Roofing	6
07 62 00	Sheet Metal Flashing and Trim	3
07 71 00	Roof Specialties	2
07 84 00	Firestopping	4
07 92 00	Joint Sealants	7
<b>Division 08 -- Openings</b>		
08 11 13	Hollow Metal Doors and Frames	5
08 14 16	Flush Wood Doors	4
08 36 13	Sectional Overhead Doors	5
08 43 13	Aluminum-Framed Storefronts	6
08 63 00	Metal-Framed Skylights	5
08 71 00	Door Hardware	8
08 80 00	Glazing	6
<b>Division 09 -- Finishes</b>		
09 05 61	Common Work Results for Flooring Preparation	6

09 21 16	Gypsum Board Assemblies	5
09 30 00	Tiling	6
09 51 00	Suspended Acoustical Ceilings	4
09 65 00	Resilient Flooring	5
09 67 00	Fluid-Applied Flooring	3
09 68 13	Tile Carpeting	3
09 91 13	Exterior Painting	6
09 91 23	Interior Painting	7
<b>Division 10 -- Specialties</b>		
10 11 01	Visual Display Boards	3
10 22 39	Folding Panel Partitions	3
10 28 00	Toilet, Bath, and Laundry Accessories	3
10 44 00	Fire Protection Specialties	2
10 51 00	Lockers	3
10 82 13	Roof Screens	7
<b>Division 11 -- Equipment</b>		
11 53 00	Laboratory Equipment	6
<b>Division 12 -- Furnishings</b>		
12 35 53.19	Wood Laboratory Casework	9
12 36 00	Countertops	5
<b>Division 21 -- Fire Suppression</b>		
21 05 00	Common Work Results for Fire Suppression	4
21 13 00	Fire-Suppression Sprinklers	3
<b>Division 22 -- Plumbing</b>		
22 05 53	Identification for Plumbing Piping and Equipment	2
22 07 19	Plumbing Piping Insulation	4
22 10 05	Plumbing Piping	9
22 10 06	Plumbing Piping Specialties	5
22 30 00	Plumbing Equipment	3
22 40 00	Plumbing Fixtures	7

22 66 00	Process Piping	4
<b>Division 23 -- Heating, Ventilating, and Air-Conditioning (HVAC)</b>		
23 05 53	Identification for HVAC Piping and Equipment	3
23 05 93	Test, Adjusting and Balancing for HVAC	4
23 07 13	Duct Insulation	3
23 07 19	HVAC Piping Insulation	3
23 09 13	Instrumentation and Control Devices for HVAC	7
23 09 23	Direct-Digital Control System for HVAC	8
23 09 26	Laboratory Airflow Control System	15
23 21 13	Hydronic Piping	7
23 21 14	Hydronic Specialties	2
23 31 00	HVAC Ducts and Casings	4
23 33 00	Air Duct Accessories	3
23 34 23	HVAC Power Ventilators	2
23 35 18	Laboratory Exhaust Systems	5
23 37 00	Air Outlets and Inlets	3
23 74 13	Packaged Outdoor Central-Station Air-Handling Units	4
23 82 00	Convection Heating and Cooling Units	4
<b>Division 26 -- Electrical</b>		
26 05 00	Basic Electrical Requirements	12
26 27 17	Equipment Wiring	3
26 51 00	Lighting	8
<b>Division 27 -- Communications</b>		
27 10 00	Structured Cabling	5
27 53 14	Clock Systems	2
<b>Division 28 -- Electronic Safety and Security</b>		
28 31 00	Fire Detection and Alarm	8
<b>Division 31 -- Earthwork</b>		
31 23 16	Excavation	2
31 23 23	Fill	4

**SECTION 00 01 15  
DRAWING INDEX**

**GENERAL**

G100	COVER SHEET, GENERAL NOTES, SYMBOLS & DRAWING INDEX
G201	ACCESSIBILITY & MOUNTING INFORMATION
G300	CODE REVIEW - BUILDING CONSTRUCTION, MEANS OF EGRESS

**CIVIL**

C100	EXISTING CONDITIONS
C200	DEMOLITION PLAN
C300	PROPOSED SITE UTILITY PLAN
C400	PROPOSED SITE GRADING PLAN AND EROSION CONTROL PLAN
C401	EROSION CONTROL NOTES AND DETAILS
C500	GENERAL NOTES AND CONSTRUCTION DETAILS

**ARCHITECTURAL**

A211	PARTIAL DEMOLITION FLOOR PLAN - AREA "A"
A212	PARTIAL DEMOLITION FLOOR PLAN - AREA "B"
A213	PARTIAL DEMOLITION REFLECTED CEILING PLAN - AREA "A"
A214	PARTIAL DEMOLITION REFLECTED CEILING PLAN - AREA "B"
A311	PARTIAL FLOOR PLAN - AREA 'A'
A312	PARTIAL FLOOR PLAN - AREA 'B'
A321	PARTIAL ROOF PLAN - AREA 'A'
A322	PARTIAL ROOF PLAN - AREA 'B'
A411	PARTIAL REFLECTED CEILING PLAN - AREA 'A'
A412	PARTIAL REFLECTED CEILING PLAN - AREA 'B'
A500	ENLARGED PLANS, PLAN DETAILS
A510	ALTERNATE #2 CANOPY SKYLIGHT PLAN ELEVATIONS, AND DETAILS
A600	BUILDING SECTIONS
A700	EXTERIOR BUILDING ELEVATIONS



A800	DOOR, FRAME & HARDWARE SCHEDULES
A810	ROOM FINISH SCHEDULE
A820	DOOR SCHEDULE
A900	INTERIOR ELEVATIONS
A901	INTERIOR ELEVATIONS
A902	INTERIOR ELEVATIONS
A1100	INTERIOR PARTITION TYPES
A1200	SECTION DETAILS

## **STRUCTURAL**

S010	GENERAL NOTES, CODE & LOADING, TESTING & INSPECTIONS, ABBREVIATIONS
S011	NOTES, SYMBOLS, & NOMENCLATURE
S311	PARTIAL FOUNDATION AND SLAB ON GRADE PLAN - AREA "A"
S312	PARTIAL FOUNDATION AND SLAB ON GRADE PLAN - AREA "B"
S321	PARTIAL ROOF FRAMING AND MASONRY WALL PLAN - AREA "A"
S322	PARTIAL ROOF FRAMING AND MASONRY WALL PLAN - AREA "B"
S400	STANDARD FOUNDATION SECTIONS AND DETAILS
S410	FOUNDATION SECTIONS AND DETAILS
S600	ROOF FRAMING SECTIONS AND DETAILS

## **MECHANICAL**

M211	PARTIAL MECHANICAL DEMOLITION PLAN - AREA "A"
M212	PARTIAL MECHANICAL DEMOLITION PLAN - AREA "B"
M311	PARTIAL MECHANICAL PLAN - AREA "A"
M312	PARTIAL MECHANICAL PLAN - AREA "B"
M410	TEMPERATURE CONTROLS
M510	MECHANICAL SCHEDULES AND DETAILS

## **PLUMBING**

P211	PARTIAL PLUMBING DEMOLITION PLAN - AREA "A"
P212	PARTIAL PLUMBING DEMOLITION PLAN - AREA "B"
P301	PARTIAL PLUMBING UNDERGROUND PLAN - AREA "A"
P302	PARTIAL PLUMBING UNDERGROUND PLAN - AREA "B"
P311	PARTIAL PLUMBING PLAN - AREA "A"
P312	PARTIAL PLUMBING PLAN - AREA "B"
P410	PLUMBING SCHEDULES AND DETAILS
P510	PLUMBING RISER DIAGRAMS

## **FIRE PROTECTION**

F311	PARTIAL FIRE PROTECTION FLOOR PLAN - AREA "A"
F312	PARTIAL FIRE PROTECTION FLOOR PLAN - AREA "B"

## **ELECTRICAL**

E050	ELECTRICAL ABBREVIATIONS & SYMBOLS LIST
E211	ELECTRICAL DEMOLITION PLAN - AREA "A"
E212	ELECTRICAL DEMOLITION PLAN - AREA "B"
E221	ELECTRICAL CEILING DEMOLITION PLAN - AREA "A"
E222	ELECTRICAL CEILING DEMOLITION PLAN - AREA "B"
E311	ELECTRICAL POWER PLAN - AREA "A"
E312	ELECTRICAL POWER PLAN - AREA "B"
E411	ELECTRICAL LIGHTING PLAN - AREA "A"
E412	ELECTRICAL LIGHTING PLAN - AREA "B"
E620	ELECTRICAL PANEL SCHEDULES & DETAILS

**END OF DOCUMENT**

**SECTION 00 31 13  
PRELIMINARY SCHEDULE**

**1.01 GENERAL**

- A. The following represents the preliminary construction schedule for the Work. This schedule is the current estimate of the Owner to be used for purposes of bidding. All Bidders shall include the costs of all overtime, double-shift, or so-called "premium" time that may be necessary to meet this milestone.

**1.02 PRELIMINARY SCHEDULE**

- A. Issue of Contract and Purchase Order: March 2017
- B. Commencement of Construction (Exterior for Science Addition and Storage Addition if Alternate No. 1 is accepted): April 4, 2017
- C. Commencement of All Other Construction: May 16, 2017
- D. JJC FF&E Install (where required): July 22, 2017
- E. Substantial Completion: July 29, 2017
- F. Punchlist Complete: August 12, 2017
- G. Close Out: August 25, 2017

**END OF DOCUMENT**

**SECTION 01 10 00  
SUMMARY**

**PART 1 GENERAL**

**1.01 PROJECT**

- A. Project Name: ROMEOVILLE CAMPUS ADDITIONS AND REMODELING.
- B. Owner's Name: Joliet Junior College.
- C. Architect/Engineer's Name: Kluber Architects + Engineers.
- D. The Project consists of the Additions and Interior Remodling of the existing single story campus building as indicated on the contract documents.

**1.02 DESCRIPTION OF ALTERATIONS WORK**

- A. Scope of demolition and removal work is shown on drawings and specified in Section 02 41 00.
- B. Scope of alterations work is shown on drawings.
- C. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- D. HVAC: Alter existing system and add new construction, keeping existing in operation.
- E. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
- F. Fire Suppression Sprinklers: Alter existing system and add new construction, keeping existing in operation.
- G. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
- H. Owner will remove the following items before start of work:
  - 1. Furnishings (furniture, computers, equipment) in all rooms scheduled to be included in the Work.
  - 2. Ceiling mounted projectors (not mounts).
  - 3. Vending machines.
- I. Contractor shall remove and deliver the following to Owner prior to start of work:
  - 1. Refrigerator in Room 45.
- J. Contractor shall remove and store the following prior to start of work, for later reinstallation by Contractor:
  - 1. As noted on the drawings, including but not limited to:
    - a. Ceiling tiles to be re-used in corridors.
    - b. Marker boards.
    - c. Electronic white boards.
    - d. Window shades.
    - e. Projection screens.

**1.03 WORK BY OWNER**

- A. Owner will supply and install the following:

1. Terminations at IT and low voltage closets.
  2. Interior signage.
  3. New WAP's (cable provided and installed by contractor).
- B. Owner will supply the following for installation by Contractor:
1. Projector screens (if additional needed).
  2. Projector mounts.

#### **1.04 OWNER OCCUPANCY**

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

#### **1.05 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site and premises to allow:
1. Owner occupancy.
  2. Work by Others.
  3. Work by Owner.
  4. Use of site and premises by the public.
- C. Provide access to and from site as required by law and by Owner:
1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Existing building spaces may not be used for storage.
- E. Time Restrictions:
1. Limit conduct of especially noisy exterior work to the hours of 7 AM - 3 PM.
  2. Interior disruptive Work to the hours of 10 PM - 6 AM.
- F. Utility Outages and Shutdown:
1. Limit disruption of utility services to hours the building is unoccupied.
  2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
  3. Prevent accidental disruption of utility services to other facilities.

#### **1.06 WORK SEQUENCE**

- A. Coordinate construction schedule and operations with Owner.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 21 00  
ALLOWANCES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

A. Contingency allowance.

**1.02 CONTINGENCY ALLOWANCE**

- A. Contractor's costs for products, delivery, installation, labor, payroll, taxes and equipment rental will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- B. Funds will be drawn from the Contingency Allowance only by Change Order.
- C. Bond, insurance, overhead and profit fees on Change Orders paid out of Contingency Allowances will not be permitted. The Contractor must carry in its Base Bid OH&P costs on Contingency Allowance funds expenditures.
- D. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.
- E. Contingency Allowance Amount: Include in the Base Bid the stipulated sum of \$75,000.00 for use upon Owner's instructions.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 23 00  
ALTERNATES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

A. Description of Alternates.

**1.02 ACCEPTANCE OF ALTERNATES**

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

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

**1.03 SCHEDULE OF ALTERNATES**

A. Alternate No. 1: Provide new Storage Room (Room 30) addition bound by grid lines 1 - 1' & D - E.8. Refer to ALL applicable drawings which describe the Work for Civil Engineering, Architecture, Structural, Mechanical, Plumbing, Fire Protection and Electrical requirements. Refer to Project Manual for the specifications of ALL applicable General, Products and Execution items required for the Work.

B. Alternate No. 2: Demolish existing covered entry canopy and Provide new entry canopy between grid lines 7 - 6.2 & A - C. Refer to ALL applicable drawings which describe the Work for Architecture and Structural requirements. Refer to Project Manual for the specifications of ALL applicable General, Products and Execution items required for this Work.

C. Alternate No. 3: Demolish and Provide the identified Work noted in Room 10 between grid lines 5.2 - 2 & B - C.2. Refer to ALL applicable drawings which describe the Work for Architecture, Mechanical, Fire Protection and Electrical requirements. Refer to Project Manual for the specifications of ALL applicable General, Products and Execution items required for the Work.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 30 00  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electronic Document Submittal service.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Submittals for review, information, and project closeout.
- F. Architect/Engineer-provided CAD files.
- G. Number of copies of Submittals.
- H. Submittal procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- B. Section 01 78 00 - Closeout Submittals: Project record documents.

**1.03 PROJECT COORDINATION**

- A. Project Coordinator: Owner (JJC), Rick Lyman or as designated by Owner.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site 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.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of Submittals to Architect/Engineer 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**

### **3.01 ELECTRONIC DOCUMENT Submittal SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format 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 information (RFIs), Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
  2. Contractor and Architect/Engineer are required to use this service.
  3. It is Contractor's responsibility to submit documents in PDF format.
  4. Subcontractors, suppliers, and Architect/Engineer's consultants are to 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 PDF 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. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the contract sum.
- C. Submittal Service: The selected service is:
  1. Submittal Exchange (tel: 1-800-714-0024): [www.Submittalexchange.com](http://www.Submittalexchange.com).
- D. Project Closeout: Architect/Engineer will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

### **3.02 PRECONSTRUCTION MEETING**

- A. Project Coordinator will schedule a meeting after Notice of Award.
- B. Attendance required:
  1. Owner.
  2. Architect/Engineer.
  3. Contractor.
- C. Agenda:
  1. Project Coordinator will prepare agenda for this meeting.

### **3.03 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Architect/Engineer.
  - 4. Contractor's Superintendent.
- 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. Review of off-site fabrication and delivery schedules.
  - 7. Maintenance of progress schedule.
  - 8. Corrective measures to regain projected schedules.
  - 9. Planned progress during succeeding work period.
  - 10. Coordination of projected progress.
  - 11. Maintenance of quality and work standards.
  - 12. Effect of proposed changes on progress schedule and coordination.
  - 13. Other business relating to Work.
- E. Record minutes and distribute copies within 2 days after meeting to participants, with copies to Architect/Engineer, Owner, participants, and those affected by decisions made.

### **3.04 CONSTRUCTION PROGRESS SCHEDULE**

- A. Within 7 days after date of the Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 7 days.

### **3.05 Submittals FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data.
  - 2. Shop drawings.
  - 3. Samples for selection.
  - 4. Samples for verification.
- B. Submit to Architect/Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only 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 78 00 - Closeout Submittals.

### **3.06 Submittals FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
  2. Certificates.
  3. Test reports.
  4. Inspection reports.
  5. Manufacturer's instructions.
  6. Manufacturer's field reports.
  7. Other types indicated.
- B. Submit for Architect/Engineer's knowledge as contract administrator or for Owner. No action will be taken.

### **3.07 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:
1. Project record documents.
  2. Operation and maintenance data.
  3. Warranties.
  4. Bonds.
  5. Other types as indicated.
- D. Submit for Owner's benefit during and after Project completion.

### **3.08 ARCHITECT/ENGINEER-PROVIDED CAD FILES**

- A. After the execution of the Contract, Architect/Engineer will provide, free of charge, upon receipt of a properly completed and signed request utilizing "Electronic Data Transfer Consent Form" at the end of this Specification Section, CAD files depicting graphic information for the project as follows:
1. Architectural Floor Plans: Column grid, walls, floors, stairs, doors, windows, room numbers, ceiling grid, mechanical diffusers, plumbing fixtures, sprinkler heads (if depicted in Bid Documents) and lights.
- B. Contractor acknowledges and accepts that the Architectural Floor Plans do not contain structural, mechanical, electrical, plumbing, fire protection and other building systems information depicted in the Bidding Documents. Examples of information not contained in these files include, but are not limited to, title blocks, keynotes, schedules, mechanical ductwork and equipment, electrical device symbols, circuit numbers and home runs, plumbing equipment, piping runs and riser diagrams, and architectural/engineering text or details. No other CAD files, data or information will be provided.
- C. Only requests from Prime Contractors will be honored. Subcontractors must obtain the files from their respective Prime Contractors.

- D. In submitting a request, Contractor acknowledges that:
1. Architect/Engineer bears no responsibility for the data or its transmission,
  2. Use of the data by the Contractor or his Subcontractors in no way relieves the Contractor of his obligations under the Contract,
  3. Contractor is solely liable for any and all claims arising from any and all products generated by the Contractor or its Subcontractors employing the data,
  4. Contractor and its Subcontractors have a limited, non-exclusive license to use the data solely in connection with the Work of the Project, and that
  5. Architect/Engineer retains all rights, including copyright, to the data.

### **3.09 NUMBER OF COPIES OF Submittals**

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

### **3.10 Submittal PROCEDURES**

- A. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
  2. Do not reproduce the Contract Documents to create shop drawings.
  3. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- B. Transmit each Submittal with a copy of approved Submittal form.
- C. Sequentially number the transmittal form. Revise Submittals with original number and a sequential alphabetic suffix.
- D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- E. 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.
- F. Deliver Submittals to Architect/Engineer at business address, unless Project Coordinator indicates samples to be delivered directly to project site.
- G. Schedule Submittals to expedite the Project, and coordinate submission of related items.
- H. For each Submittal for review, allow 20 days excluding delivery time to and from the Contractor.
- I. Clearly identify variations from the Contract Documents. Regardless of the type of variation, Contractor is solely responsible for errors in the field that arise from Submittal variations from the

requirements of the Contract Documents if those variations were not expressly noted to specifically identify for and describe to the reviewer the nature of the variation from the Contract Documents.

- J. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- K. Correlate submitted items with specified products; clearly indicate the specified product that corresponds to each submitted item.
- L. When options or optional features available for a Product are indicated in a Submittal, and selections for those options/features are indicated in the Contract Documents, identify on the Submittal the selection indicated in the Contract Documents.
- M. Provide space for Contractor and Architect/Engineer review stamps.
- N. When revised for resubmission, using clouds, highlights or other means acceptable to the Architect, identify all changes made since previous submission. Resubmittals that do not clearly identify all changes may be delayed and/or returned to the Contractor unreviewed.
- O. The Contractor is entitled to 1 Resubmittals of any Shop Drawing, Product Data, or Closeout Submittal item rejected by the Architect or returned by the Architect for further action. Thereafter, the Contractor shall pay the cost of all further Architect's reviews of Shop Drawing, Product Data or Closeout Submittal, at a rate of \$200.00/hour. Cost of such further reviews will be deducted from the Contract Sum by Change Order.
- P. Distribute reviewed Submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- Q. Submittals not requested will not be recognized or processed.
- R. Submittal reviews may be delayed and/or Submittals may be returned unreviewed for any of the following reasons:
  - 1. Submittals submitted outside the scheduled dates of the Submittal Schedule.
  - 2. Submittals are incomplete or are missing information.
  - 3. Submittals are not submitted in accordance with procedures outlined in this Section (i.e. spec Section number not indicated, missing Contractor's review stamp, submitted items not correlated with specified products).

**END OF SECTION**



## ELECTRONIC DATA TRANSFER CONSENT FORM

Project: ROMEOVILLE CAMPUS  
ADDITIONS AND REMODELING

Kluber Project: 15-292-1010

Owner: JOLIET JUNIOR COLLEGE

KLUBER, INC., an Illinois corporation, is providing electronic data to you solely at your request and for your convenience. By accepting and opening any of the electronic data files, you agree that Kluber, Inc. bears no liability for the data or its transmission to you and that you are solely liable for any and all claims referring or relating to any and all products you, or your Subcontractors, may generate with the data.

You acknowledge that you have a limited non-exclusive license to use the information solely in connection with your work on the project captioned above, and that Kluber, Inc. retains all rights, including copyright, to the data.

Acknowledged by: \_\_\_\_\_  
(Printed Name) (Signature)

Company: \_\_\_\_\_

Date: \_\_\_\_\_ Email: \_\_\_\_\_

Architectural Floor Plans are transmitted for the contractors' use as backgrounds for shop drawings and as-built drawings, and, as such, contain graphic information for column grid, walls, floors, stairs, doors, windows, room numbers, ceiling grid, lights, receptacles, diffusers and sprinkler heads where indicated on Bid Documents. Plans do not contain title blocks, keynotes, schedules, mechanical ductwork and equipment, electrical device symbols, circuit numbers and home runs, plumbing equipment, piping runs and riser diagrams, and architectural/engineering text and details. Plans depict entire floors and are not formatted, partial plans as depicted in the Bidding Documents. Files are provided in R2000 .DWG format.)

**SECTION 01 40 00  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Submittals.
- B. Sequencing and scheduling of the work with testing and inspections.
- C. Testing and inspection agencies and services.
- D. Control of installation.
- E. Mock-ups.
- F. Tolerances.
- G. Manufacturers' field services.
- H. Defect Assessment.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 41 00 - Regulatory Requirements.
- B. Section 01 42 00 - References.
- C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- G. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).
- H. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2010.
- I. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2008.

- J. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2010a.
- K. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2010b.
- L. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2009.
- M. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2011.
- N. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2010.
- O. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2008) .
- P. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2010.
- Q. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength; 2009.
- R. ASTM E514 - Standard Test Method for Water Penetration and Leakage Through Masonry ; 2009.
- S. ASTM E165 - Standard Test Method for Liquid Penetrant Examination; 2009.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect/Engineer's knowledge as contract administrator for the limited purpose of assessing conformance 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/Engineer 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. Conformance with Contract Documents.
    - k. When requested by Architect/Engineer, provide interpretation of results.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect/Engineer, in quantities specified for Product Data.



1. Indicate material or product conforms to 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.

#### **1.05 REGULATORY REQUIREMENTS - See Section 01 41 00**

#### **1.06 REFERENCES AND STANDARDS - See Section 01 42 00**

#### **1.07 TESTING AND INSPECTION AGENCIES AND SERVICES**

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection, except where specifically indicated otherwise in the Schedule of Tests and Inspections.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.

2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.

#### **1.08 SEQUENCING AND SCHEDULING**

A. Soils Testing: As each portion of the Work is completed, notify testing laboratory to perform compaction and moisture density tests.

1. Test compaction of existing and placed materials no more than seven (7) days prior to placement of the next portion of the Work, and only when no rain is expected between the time of the test and the placement of the next portion of the Work.

2. Proceed promptly with additional portions of the Work only after satisfactory results have been verified in writing.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 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/Engineer 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.

### **3.02 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/Engineer will use to judge the Work.
- C. Integrated Exterior Mock-ups: construct integrated exterior mock-up as indicated on Drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Notify Architect/Engineer seven (7) working days in advance of dates and times when mock-ups will be constructed.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect/Engineer's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Architect/Engineer will issue written comments within five (5) working days of initial review and each subsequent follow up review of each mock-up.
  - 2. 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/Engineer 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/Engineer.

### **3.03 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/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### **3.04 TESTING AND INSPECTION**

#### **A. Testing Agency Duties:**

1. Provide qualified personnel at site. Cooperate with Architect/Engineer 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/Engineer and Contractor of observed irregularities or non-conformance of Work or products.
5. Perform additional tests and inspections required by Architect/Engineer.
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. Notify Architect/Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. 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-conformance to specified requirements shall be performed by the same agency on instructions by Architect/Engineer.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

### **3.05 SCHEDULE OF TESTS AND INSPECTIONS:**

#### **A. Concrete Testing and Inspection: Owner's Testing Service.**

1. Section 03 20 00 - Concrete Reinforcing:
  - a. Inspect reinforcement for bar size, quantity, cover and support prior to casting concrete.
2. Section 03 30 00 - Cast-in-Place Concrete:
  - a. Compressive strength tests: ASTM C172 and ASTM C39.

- 1) Samples for each day's pour greater than 5 cubic yards. Sample every 50 cubic yards.
  - 2) Sample shall consist of 4 specimens. Break schedule: 1 at 7 days, 2 at 28 days and final held for possible future break if directed by Architect/Engineer.
  - 3) Slump: ASTM C 143; one for each set of test cylinders.
  - 4) Air Content: ASTM C 231.
  - 5) Concrete Temperature: ASTM C 1064.
  - 6) Unit Weight: ASTM C 567.
  - 7) Take one additional cylinder during cold weather, cured on site under same conditions as the concrete it represents.
- b. Measure F(F) and F(L) in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.
- B. Masonry Testing and Inspection: Owner's Testing Service.
1. Section 04 20 00 - Unit Masonry:
    - a. Masonry mortar tests: ASTM C 270.
    - b. Masonry grout tests: ASTM C 1019.
    - c. Inspect masonry anchorage and reinforcement for placement, bar size, quantity, spacing, and lap lengths.
    - d. Masonry Assemblies: Tested in accordance with the provisions of ACI 530.1/ASCE6/TMS 602.
- C. Structural Steel/Decking Testing and Inspection: Owner's Testing Service.
1. Section 05 12 00 - Structural Steel Framing:
    - a. Provide testing and verification of shop and field-bolted connections in accordance with AISC "Specification for Structural Joints using ASTM A 325 or A 490 bolts".
    - b. Visually inspect all shop and field welds for placement and size.
  2. Section 05 31 00 - Steel Decking:
    - a. Visually inspect deck welds and sidelap fasteners.
    - b. Verify deck type and gauge.
- D. Soils Testing: Owner's Testing Service.
1. Section 31 23 16 - Excavation and Section 31 23 23 - Fill:
    - a. Test and inspect subgrades and each fill or backfill layer.
    - b. Building pad and footing subgrades to verify design bearing capacities. Perform testing in accordance with project soils report.
    - c. Test compaction of soils ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937 as applicable.
    - d. Paved and building slab areas subgrade at least one test for every 2,500 square feet.
    - e. Foundation backfill compaction of initial and final layer. Perform at least one test every 200 feet.
- E. Asphalt Paving Testing and Inspection: Owner's Testing Service.
1. Refer to Civil Engineering documents.
- F. Concrete Paving Testing and Inspection: Owner's Testing Service.
1. Refer to Civil Engineering documents.

- G. Sanitary Sewer Piping Testing: Contractor's Testing Service.
  - 1. Refer to Civil Engineering documents.

### **3.06 MANUFACTURERS' FIELD SERVICES**

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

### **3.07 DEFECT ASSESSMENT**

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct an appropriate remedy or adjust payment.

**END OF SECTION**

**SECTION 01 41 00  
REGULATORY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General.
- B. Definitions.
- C. Quality Assurance.
- D. Regulatory Requirements.

**1.02 RELATED SECTIONS**

- A. Section 01 10 00 - Summary.
- B. Section 01 42 00 - References.

**1.03 GENERAL**

- A. Comply with all applicable laws, rules, regulations, codes and ordinances.
- B. If the Contractor observes that the Contract Documents may be at variance with specified codes, notify the Architect/Engineer immediately. Architect/Engineer shall issue all changes in accordance with the General Conditions.
- C. It shall not be the Contractor's primary responsibility to make certain that the Contract Documents are in accordance with all applicable laws, rules and regulations, however, when the Contractor performs work knowing or having reason to know that the work in question is contrary to applicable laws, rules, and regulations, and fails to notify the Architect/Engineer, the Contractor shall pay all costs arising therefrom.

**1.04 DEFINITIONS**

- A. Definitions:
  - 1. Codes: Codes are statutory requirements, rules or regulations of governmental entities.
  - 2. Standards: Standards are requirements that have been established as accepted criteria, set general consent.

**1.05 QUALITY ASSURANCE**

- A. The Architect/Engineer has designed the project to applicable code requirements and has copies of said codes available for the Contractor's inspection.
- B. The Contractor shall:
  - 1. Ensure that copies of codes and standards referenced herein or specified in individual specifications sections are available to Contractor's personnel, agents, and Sub-Contractors.
  - 2. Ensure that Contractor's personnel, agents, and Sub-Contractors are familiar with the workmanship and requirements of applicable codes and standards.

## 1.06 REGULATORY REQUIREMENTS

- A. Source and Requirements: Verify amendments with local code officials.
1. Local code requirements:
    - a. ICC International Building Code, 2009 Edition.
    - b. ICC International Mechanical Code, 2009 Edition.
    - c. ICC International Fire Code, 2009 Edition.
    - d. ICC International Property Maintenance Code, 2009 Edition.
    - e. ICC Electrical Code, 2000 Edition.
  2. State code requirements:
    - a. Capital Development Board (CDB):
      - 1) Illinois Accessibility Code, 1997 Edition.
      - 2) Illinois Energy Conservation Code (ICC International Energy Conservation Code, 2012 Edition, with State of Illinois modifications.
    - b. Illinois Department of Labor (IDOL): Safety Glazing Materials Act - Illinois Revised Statutes, chap. 111 1/2, paragraph 3101, et seq.
    - c. Illinois Department of Public Health (IDPH):
      - 1) Illinois Plumbing Code (Illinois Administrative Code, Title 77, Chapter I, Subchapter r, Part 890).
    - d. Illinois Environmental Protection Agency (IEPA):
      - 1) Air-Pollution Standards.
      - 2) Noise Pollution Standards.
      - 3) Water Pollution Standards.
      - 4) Public Water Supplies
      - 5) Solid Waste Standards.
      - 6) Illinois Recommended Standards for Sewage Works (Illinois Administrative Code, Title 35, Subtitle C, Chapter II, Part 370).
    - e. Illinois State Fire Marshal (OSFM):
      - 1) Boiler & Pressure Vessel Safety Code (Illinois Administrative Code, Title 44, Chapter I, Part 120).
      - 2) Illinois Rules & Regulations for Fire Prevention & Safety (as amended).
      - 3) Gasoline and Volatile Oils (Illinois Revised Statutes, chap. 17 1/2, paragraph 31, et seq.).
  3. Information and Requirements for Utility Services: Local utility companies.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION - NOT USED

**END OF SECTION**

**SECTION 01 42 00  
REFERENCES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Drawing symbols, abbreviations and acronyms.
- B. Definitions of terms used throughout the Contract Documents.
- C. Explanation of specification format and content.
- D. Requirements relating to referenced standards.
- E. Applicability of referenced standards.
- F. List of industry organizations and certain of their respective documents.

**1.02 DRAWING SYMBOLS AND CONVENTIONS**

- A. Abbreviations and graphic symbols are defined on the General Notes, Symbols & Abbreviations sheet of the drawings.
- B. Generally, symbols used on the mechanical and electrical drawings conform to those recommended by ASHRAE, though, where appropriate, these symbols are supplemented by more specific symbols as recommended by ASME, ASPE, or the IEEE.

**1.03 DEFINITIONS**

- A. Where the terms "indicated", "noted", "scheduled", "shown", or "specified" are used it is to help locate the reference; no limitation on location is intended except as specifically noted.
- B. Where the terms "directed", "requested", "authorized", "approved", are used as in "directed by the Architect/Engineer", no implied meaning shall be construed to extend the Architect/Engineer's responsibilities into the Contractor's purview of construction supervision.
- C. Where the term "approved" is used in conjunction with the Architect/Engineer's action on submittals, requests or applications it is limited to the duties of the Architect/Engineer as described in the Agreement, and the General and Supplemental Conditions of the Contract. Such use of the term "approval" shall not limit or release the Contractor from his responsibility to fulfill Contract requirements.
- D. Where the term "regulations" is used it means all applicable statutes, laws, ordinances, and orders issued by authorities having jurisdiction, as well as construction industry standards, rules, or conventions that address performance of the Work.
- E. Where the term "furnish" is used it means supply, deliver, and unload to the construction site ready for assembly and incorporation into the Work.
- F. Where the term "install" is used it is meant to describe operations at the job site to include unloading, assembling, placing, anchoring, finishing, protecting, cleaning and all other similar operations required to fully incorporate an item into the Work.
- G. Where the term "provide" is used it means "furnish and install" as defined above.



H. The "Project Site" is the space available to the Contractor for performance of construction activities. The Project Site may be for the exclusive use of the Contractor and his activities or may be used in conjunction with others with others performing other construction or related activities on the Project. The Extent of the Project Site is indicated on the Drawings.

#### **1.04 SPECIFICATION FORMAT AND CONTENT**

- A. These Specifications are based on the Construction Specification Institute's 49 Division format and numbering system.
- B. Language used in the Specifications and other Contract Documents is an abbreviated type. Implied words and meanings will appropriately interpreted.
- C. Requirements expressed in imperative and streamlined language are to be performed by the Contractor. At certain locations in the text, subjective language may be used to describe responsibilities that must be fulfilled indirectly by the Contractor or others.
  - 1. Whenever a colon (:) is used within a sentence or phrase, it shall be construed to mean the words "shall be".
- D. Use of certain terms such as "carpentry" is not intended to imply that certain activities must be performed by accredited or unionized individuals of a corresponding generic name. The Specifications do, however, require that certain construction activities shall be performed by specialists who are recognized experts in the operations to be performed. Specialists shall be used for said activities, however the final responsibility for fulfilling the requirements of the Contract remains the Contractor's.

#### **1.05 QUALITY ASSURANCE**

- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue specified in this section, except where a specific date is established by applicable code.
- C. Obtain copies of standards when required by the Contract Documents.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect/Engineer before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect/Engineer shall be altered by the Contract Documents by mention or inference otherwise in any reference document.

#### **1.06 APPLICABILITY OF INDUSTRY STANDARDS**

- A. Construction industry standards shall have the same force and effect as if bound or copied directly in the Contract Documents, except where more stringent requirements are specified. All such applicable standards are made a part of the Contract Documents by reference.

1. Where compliance with two or more standards are referenced and conflicting requirements for quality or quantities occur, comply with the more stringent requirements. Refer questions regarding apparently conflicting standards to the Architect for a decision before proceeding.
2. The standard of quality or quantity levels specified, shown, or referenced shall be the minimum to be provided or performed. Refer questions regarding standards of minimum quality or quantity to the Architect before proceeding.

#### **1.07 CONSTRUCTION INDUSTRY ORGANIZATIONS AND DOCUMENTS**

- A. AA -- ALUMINUM ASSOCIATION, INC.
- B. AABC -- ASSOCIATED AIR BALANCE COUNCIL
- C. AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION
- D. ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL
- E. AGA -- AMERICAN GALVANIZERS ASSOCIATION, INC.
- F. AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.
- G. ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE
- H. ASCE -- AMERICAN SOCIETY OF CIVIL ENGINEERS
- I. ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
- J. ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
- K. ASTM -- AMERICAN SOCIETY FOR TESTING AND MATERIALS
- L. AWI -- ARCHITECTURAL WOODWORK INSTITUTE
- M. AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION
- N. AWS -- AMERICAN WELDING SOCIETY
- O. BHMA -- BUILDERS HARDWARE MANUFACTURERS ASSOCIATION
- P. BIA -- BRICK INDUSTRY ASSOCIATION
- Q. CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION
- R. CRSI -- CONCRETE REINFORCING STEEL INSTITUTE
- S. DHI -- DOOR AND HARDWARE INSTITUTE
- T. DIN -- DEUTSCHES INSTITUT FUR NORMUNG
- U. FM -- FACTORY MUTUAL RESEARCH CORPORATION
- V. ICC -- INTERNATIONAL CODE COUNCIL, INC.
- W. IEEE -- INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
- X. ISO -- INTERNATIONAL STANDARDS ORGANIZATION

- Y. MFMA -- MAPLE FLOORING MANUFACTURERS ASSOCIATION
- Z. NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS
- AA. NCMA -- NATIONAL CONCRETE MASONRY ASSOCIATION
- AB. NEBB -- NATIONAL ENVIRONMENTAL BALANCING BUREAU
- AC. NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
- AD. NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION
- AE. NRCA -- NATIONAL ROOFING CONTRACTORS ASSOCIATION
- AF. PCI -- PRECAST/PRESTRESSED CONCRETE INSTITUTE
- AG. SDI -- STEEL DOOR INSTITUTE
- AH. SDI -- STEEL DECK INSTITUTE, INC.
- AI. SGCC -- SAFETY GLAZING CERTIFICATION COUNCIL
- AJ. SIGMA - SEALED INSULATING GLASS MANUFACTURERS ASSOCIATION (See IGMA)
- AK. SJI -- STEEL JOIST INSTITUTE
- AL. SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.
- AM. SPRI -- SINGLE PLY ROOFING INSTITUTE
- AN. SSPC -- THE SOCIETY FOR PROTECTIVE COATINGS
- AO. TCA -- TILE COUNCIL OF AMERICA, INC.
- AP. UL -- UNDERWRITERS LABORATORIES INC.
- AQ. USG -- UNITED STATES GYPSUM
  - 1. USG (HB) - Gypsum Construction Handbook; Seventh Edition.
- AR. WWPA -- WESTERN WOOD PRODUCTS ASSOCIATION

#### **1.08 UNITED STATES GOVERNMENT AND RELATED AGENCIES/DOCUMENTS**

- A. CFR -- CODE OF FEDERAL REGULATIONS
- B. CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION
- C. EPA -- ENVIRONMENTAL PROTECTION AGENCY
- D. FS -- FEDERAL SPECIFICATIONS AND STANDARDS (General Services Administration)
- E. GSA -- U.S. GENERAL SERVICES ADMINISTRATION
- F. USGS -- UNITED STATES GEOLOGICAL SURVEY

#### **1.09 STATE GOVERNMENT AND RELATED AGENCIES/DOCUMENTS**

- A. CDB -- ILLINOIS CAPITAL DEVELOPMENT BOARD

- B. IDOL -- ILLINOIS DEPARTMENT OF LABOR
- C. IDPH -- ILLINOIS DEPARTMENT OF PUBLIC HEALTH
- D. IEPA -- ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
- E. OSFM -- OFFICE OF THE ILLINOIS STATE FIRE MARSHAL.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

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

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power and metering, consisting of connection to existing facilities.
  - 2. Water supply, consisting of connection to existing facilities.
- B. Existing facilities may not be used.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

**1.03 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  - 1. One (1) mobile cellular telephone for each of Contractor's and any Subcontractor's field personnel.

**1.04 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.

**1.05 BARRIERS**

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

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

#### **1.06 FENCING**

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

#### **1.07 EXTERIOR ENCLOSURES**

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

#### **1.08 INTERIOR ENCLOSURES**

- A. Provide temporary partitions and ceilings 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:

#### **1.09 VEHICULAR ACCESS AND PARKING**

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Existing parking areas may be used for construction parking.

#### **1.10 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.

#### **1.11 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**

**SECTION 01 60 00  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.
- B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

**1.03 SUBMITTALS**

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

**PART 2 PRODUCTS**

**2.01 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- C. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.



1. See Section 01 10 00 for list of items required to be salvaged for reuse and relocation.
2. If reuse of other existing materials or equipment is desired, submit substitution request.

## **2.02 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Designed, manufactured, and tested in accordance with industry standards.
- C. Where all other criteria are met, Contractor shall give preference to products that:
  1. If used on interior, have lower emissions, as defined in Section 01 61 16.
  2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.
  3. Have a published GreenScreen Chemical Hazard Analysis.

## **2.03 PRODUCT OPTIONS**

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

## **2.04 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location directed by Owner's representative; obtain Owner's signature on receipt for delivery prior to final payment. Submit signed receipts with Closeout Submittals.

## **PART 3 EXECUTION**

### **3.01 SUBSTITUTION PROCEDURES**

- A. Substitutions Prior To Bid Opening: Architect/Engineer will consider a written request for substitution provided that such request is received at least seven (7) days prior to the Bid opening date. Requests received after that time will not be considered.
  1. If a request is approved, the Architect/Engineer will issue an appropriate addendum not less than three (3) days prior to the Bid opening date.
- B. Substitutions After Notice of Award: Architect/Engineer will consider a request for substitution only under one or more of the following conditions:
  1. Substitution is required for compliance with final interpretation of code requirements or insurance regulations.
  2. Specified product is not available through no fault of the Contractor.
  3. Specified product is not compatible with other specified materials/equipment.
  4. Manufacturer will not certify or warranty specified product as required.
- C. A request for substitution 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.
  2. Agrees to provide the same warranty for the substitution as for the specified product.
  3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
  4. Waives claims for additional costs or time extension that may subsequently become apparent.
  5. Agrees to reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction over the Project.
- D. Substitutions of products or product characteristics/components/accessories will not be considered when they are indicated or implied on Contractor's submittals, without separate written request, or when acceptance will require revision to the Contract Documents, whether rejection of said substitutions is expressly identified by Architect/Engineer on Contractor's submittals or not.

### **3.02 OWNER-SUPPLIED PRODUCTS**

- A. See Section 01 10 00 - Summary for identification of Owner-supplied products.
- B. 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.
- C. 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.
  5. Make final connections to Owner-provided equipment, and test equipment.

### **3.03 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.

### **3.04 STORAGE AND PROTECTION**

- A. 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.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- 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. Do not store products directly on the ground.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- L. Prevent contact with material that may cause corrosion, discoloration, or staining.
- M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- N. 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**

SUBSTITUTION REQUEST FORM

TO: \_\_\_\_\_

PROJECT: \_\_\_\_\_

SPECIFIED ITEM:

Section	Page	Paragraph	Description

The undersigned requests consideration of the following:

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

Attached data includes project description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailings, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Signature \_\_\_\_\_ For use by the design consultant

Firm \_\_\_\_\_  Accepted  Accepted as noted

Address \_\_\_\_\_  Not Accepted  Received too late

\_\_\_\_\_ By: \_\_\_\_\_

Date \_\_\_\_\_ Date \_\_\_\_\_

Telephone \_\_\_\_\_ Remarks \_\_\_\_\_

Attachments:

**SECTION 01 61 16**  
**VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Requirement for installer certification that they did not use any non-compliant products.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

**1.03 DEFINITIONS**

- A. Interior of Building: Anywhere inside the exterior weather barrier.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

**PART 3 EXECUTION**

**3.01 FIELD QUALITY CONTROL**

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

**END OF SECTION**

**SECTION 01 70 00**  
**EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
- F. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- G. Section 07 84 00 - Firestopping.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - 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 conformance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.

- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
  - 2. Identify demolition firm and submit qualifications.
  - 3. Include a summary of safety procedures.
- D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.

#### **1.04 QUALIFICATIONS**

- A. For demolition work, employ a firm specializing in the type of work required.
  - 1. Minimum of 5 years of documented experience.
- B. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect/Engineer. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
- C. For design of temporary shoring and bracing, employ a Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

#### **1.05 PROJECT CONDITIONS**

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. 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 barriers between construction areas and areas continuing to be occupied by Owner.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

- H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

## **1.06 COORDINATION**

- A. See Section 01 10 00 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 shown 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**

### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.



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

### **3.02 PREPARATION**

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

### **3.03 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/Engineer 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/Engineer, Owner, participants, and those affected by decisions made.

### **3.04 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect/Engineer of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.

- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.05 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.

### **3.06 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 shown.
  - 2. Report discrepancies to Architect/Engineer before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove items indicated on drawings.
  - 2. Relocate items indicated on drawings.
  - 3. 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.
  - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. See Section 01 10 00 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.
- D. 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.
- E. 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/Engineer.
  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/Engineer review and request instructions.
- F. 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.
- G. 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.
- H. Clean existing systems and equipment.
- I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- J. Do not begin new construction in alterations areas before demolition is complete.
- K. Comply with all other applicable requirements of this section.

### **3.07 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-conforming work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
  - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  - 2. Match color, texture, and appearance.
  - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.08 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.

### **3.09 PROTECTION OF INSTALLED WORK**

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

### **3.10 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. 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.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. 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 79 00 - Demonstration and Training.

### **3.12 ADJUSTING**

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

### **3.13 FINAL CLEANING**

- A. Execute final cleaning prior to final project assessment.
  - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.

- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and \_\_\_\_\_.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. 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. See Section 01 77 00 for additional requirements.
- B. Make submittals that are required by governing or other authorities.
- C. 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.
- D. Notify Architect/Engineer when work is considered ready for Architect/Engineer's Substantial Completion inspection.
- E. 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/Engineer's Substantial Completion inspection.
- F. Owner will occupy portions of the building as specified in Section 01 10 00.
- G. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect/Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect/Engineer.
- H. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- I. Notify Architect/Engineer when work is considered finally complete and ready for Architect/Engineer's Substantial Completion final inspection.
- J. Complete items of work determined by Architect/Engineer listed in executed Certificate of Substantial Completion.

**END OF SECTION**

**SECTION 01 77 00  
CLOSEOUT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES:**

- A. Substantial Completion Procedures.
- B. Final Completion Procedures.

**1.02 RELATED REQUIREMENTS:**

- A. Section 01 10 00 - Summary.
- B. Section 01 78 00 - Closeout Submittals.

**1.03 SUBSTANTIAL COMPLETION PROCEDURES**

- A. Substantial Completion Procedures will be in accordance with the General Conditions of the Contract for Construction, Article 9.8 and include the following:
  - 1. When the Work or a portion of the Work is considered to be substantially complete, the Contractor inspects the project and prepares a comprehensive list of outstanding items to be completed or corrected, Initial Punch List.
  - 2. Contractor submits notice of Substantial Completion.
  - 3. Contractor completes items on the Initial Punch List.
  - 4. Architect/Engineer inspects the project to verify substantial completion and prepares a Final Punch List.
  - 5. Architect/Engineer prepares Certificate of Substantial Completion, acceptance is required by Owner and Contractor.

**1.04 FINAL COMPLETION PROCEDURES**

- A. Final Completion Procedures will be in accordance with the General Conditions of the Contract for Construction, Article 9.10, and include the following:
  - 1. When items on Initial and Final Punch Lists are complete, the Contractor submits notice of final completion and final application for payment.
  - 2. Contractor submits Final Closeout Submittals as specified in Section 01 78 00.
  - 3. Architect inspects project and verifies the Work is acceptable and conforms with the Contract Documents.
  - 4. Architect processes final application for payment and closeout submittals.

**1.05 CORRECTION PERIOD**

- A. Correction Period commences on the date of Substantial Completion and expires one year from that date.
- B. Owner: document non-conforming or defective work over course of Correction Period. Notify Contractor in writing of nonconforming or defective work. Copy Architect/Engineer.
  - 1. Life safety issues requiring immediate corrective work: Contact Contractor for action.
- C. Post Construction Walk Through:
  - 1. Time: eleven months after the date of Substantial Completion convene a meeting on site.

2. Attendees: Architect/Engineer, Owner's Representative, End User and Maintenance Staff.
3. Minimum Agenda:
  - a. Review Owner's list of non-conforming or defective work.
  - b. Conduct a walk through of the building and grounds
  - c. Prepare a list of additional non-conforming or defective work items.
4. Architect/Engineer:
  - a. Prepare written report of findings within two weeks of meeting.
  - b. Notify Contractor of impending corrective work requiring action.
  - c. Monitor execution of corrective Work.

**PART 2 PRODUCTS - NOT USED.**

**PART 3 EXECUTION - NOT USED.**

**END OF SECTION**



**SECTION 01 78 00  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

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

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
- 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. Changes made by Addenda and modifications.
- F. Record Drawings : Legibly mark each item to record actual construction including:
  - 1. Field changes of dimension and detail.
  - 2. Details not on original Contract drawings.

### **3.02 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.

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

- A. For Each Product, Applied Material, and Finish:
- 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. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

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

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. 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.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Additional Requirements: As specified in individual product specification sections.

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

- A. Assemble operation and maintenance data into 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. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. 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.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect/Engineer, Consultants, Contractor and subcontractors, with names of responsible parties.

- H. 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.
- I. 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.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

### **3.06 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

**END OF SECTION**

**SECTION 01 79 00  
DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 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.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 91 13 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - 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/Engineer 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.

#### **1.04 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**

#### **3.01 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.

#### **3.02 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**

**SECTION 02 41 00  
DEMOLITION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Selective demolition of building elements for alteration purposes.
- D. Abandonment and removal of existing utilities and utility structures.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 01 70 00 - 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.
- F. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

**1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

**1.04 DEFINITIONS**

- A. Where the term "demolish" is used it shall be construed to mean remove and legally dispose of off site.
- B. Where the term "refurbish" is used it shall be construed to mean refinish, repair and otherwise restore to like-new condition.
- C. Where the term "relocate" is used it shall be construed to mean disconnect from existing utilities, move to new location and reinstall and reconnect to utilities.
- D. Where the term "salvage" is used it shall be construed to mean carefully remove so as to prevent damage.
  - 1. If the item is to be saved for reinstallation or relocation as part of the Work, "salvage" shall also be construed to mean clean, adjust, lubricate and otherwise restore to best possible condition



without repair or refinishing. Otherwise, "salvage" shall mean clean item surfaces and turn over to the Owner for storage and possible future use.

- E. Where the phrase "salvage in place" is used it shall be construed to mean protect in place so as to prevent damage while adjacent elements are demolished, restore to best possible condition without repair or refinishing, and modify as necessary to properly incorporate and integrate with new Work.

## **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
  - 1. Areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Identify demolition firm and submit qualifications.
  - 3. Include a summary of safety procedures.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

## **1.06 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
  - 1. Minimum of 3 years of documented experience.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

## **PART 3 EXECUTION**

### **3.01 SCOPE**

- A. Remove paving and curbs as required to accomplish new work.
- B. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.
- C. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.
- D. Remove concrete slabs on grade as indicated on drawings.
- E. Remove other items indicated, for salvage, relocation, and recycling.

### **3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with other requirements specified in Section 01 70 00.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
  2. Comply with applicable requirements of NFPA 241.
  3. Use of explosives is not permitted.
  4. 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.
  5. Provide, erect, and maintain temporary barriers and security devices.
  6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  8. Do not close or obstruct roadways or sidewalks without permit.
  9. 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.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.
- E. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- F. 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.
- G. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- H. If hazardous materials are discovered during removal operations, stop work and notify Architect/Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- I. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Dismantle existing construction and separate materials.
  2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- J. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

### **3.03 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 disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. 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.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

### **3.04 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 shown.
  - 2. Report discrepancies to Architect/Engineer 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 50 00 .
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- 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.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): 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. See Section 01 10 00 for other limitations on outages and required notifications.
  - 4. Verify that abandoned services serve only abandoned facilities before removal.
  - 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.
- 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.
  - 4. Patch as specified for patching new work.

### **3.05 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**

**SECTION 03 10 00  
CONCRETE FORMING AND ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete.

**1.03 REFERENCE STANDARDS**

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- D. ACI 347R - Guide to Formwork for Concrete; 2014.
- E. PS 1 - Structural Plywood; 2009.

**1.04 DESIGN REQUIREMENTS**

- A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

**1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

**PART 2 PRODUCTS**

**2.01 FORMWORK - GENERAL**

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Chamfer outside corners of beams, joists, columns, and walls.
- D. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.
- E. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

## **2.02 WOOD FORM MATERIALS**

A. Form Materials: At the discretion of the Contractor.

## **2.03 FORMWORK ACCESSORIES**

A. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Composition: Colorless mineral oil-based compound.
2. Do not use materials containing diesel oil or petroleum-based compounds.

B. Filler Strips for Chamfered Corners: Rigid plastic type; 3/4 x 3/4 inch size; maximum possible lengths.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

### **3.02 ERECTION - FORMWORK**

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Provide fillet and chamfer strips on external corners of exposed corners.

G. Coordinate this section with other sections of work that require attachment of components to formwork.

H. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

### **3.03 APPLICATION - FORM RELEASE AGENT**

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

### **3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

### **3.05 FORM CLEANING**

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
  - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
  - 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

### **3.06 FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

### **3.07 FIELD QUALITY CONTROL**

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

### **3.08 FORM REMOVAL**

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

**END OF SECTION**

**SECTION 03 20 00  
CONCRETE REINFORCING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.

**1.03 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- C. ACI SP-66 - ACI Detailing Manual; 2004.
- D. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- F. WWR-500- Manual of Standard Practice; Structural Welded Wire Reinforcement; Wire Reinforcement Institute; latest edition.
- G. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; latest edition.
- H. CRSI (P1) - Placing Reinforcing Bars; 2011.

**1.04 SUBMITTALS**

- A. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

**1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Prepare shop drawings under the supervision of a qualified Structural Engineer (SE) experienced and licensed in design of work of this type and licensed in the State in which the Project is located.

**PART 2 PRODUCTS**

**2.01 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 - 60,000 psi.
  - 1. Deformed billet-steel bars.
  - 2. Unfinished.
- B. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.



1. Form: Flat Sheets.
  2. Mesh Size and Wire Gage: As indicated on drawings.
- C. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
  2. Chairs, Bolsters, Bar Supports, Spacers: Factory made wire bar supports sized and shaped for adequate support of reinforcement during concrete placement.
  3. Provide stainless steel components for placement within 1-1/2 inches of weathering surfaces.

## **2.02 FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
  1. Review locations of splices with Architect/Engineer.

## **PART 3 EXECUTION**

### **3.01 PLACEMENT**

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Reinforcing "pull-up" during placement of concrete not acceptable.
- B. Accommodate placement of formed openings.
- C. Conform to applicable code for concrete cover over reinforcement.

### **3.02 FIELD QUALITY CONTROL**

- A. An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.
- B. Provide free access to concrete operations at project site and cooperate with the appointed firm.

**END OF SECTION**

**SECTION 03 24 16**  
**SYNTHETIC MACRO FIBER REINFORCEMENT**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Macro fiber reinforcement used in concrete slab-on-grade construction.

**1.02 RERERENCE STANDARDS**

- A. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007).
- B. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1999.
- C. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 1988 (Reapproved 2002).
- D. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001.
- E. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.
- F. ACI 544.2R, Measurement of Properties of Fiber Reinforced Concrete.
- G. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2007.
- H. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2008.
- I. ASTM C 1018-97, Standard Test Method for Flexural Toughness and First-Crack Strength of Fiber Reinforced Concrete (Using Beam with Third Point Loading).
- J. ASTM C 1116-03, Standard Specification for Fiber-Reinforced Concrete and Shotcrete
- K. ASTM C 1399-04, Obtaining Average Residual Strength of Fiber Reinforced Concrete
- L. ASTM C 1609-05, Standard Test Method for Flexural Performance of Fiber Reinforced -Concrete (Using Beam With Third-Point Loading)
- M. JCI-SF 4, Method of Tests for Flexural Strength and Flexural Toughness of Fiber Reinforced Concrete
- N. ASTM E 119, Fire Tests of Building Construction and Materials.

**1.03 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-In-Place Concrete.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements, limitations and recommendations for each material.

C. Samples: Submit samples of synthetic macro fiber.

## **1.05 QUALITY ASSURANCE**

- A. Materials: For all admixtures required for the work of this Section, provide materials which are products of one manufacturer.
- B. Pre-Construction Conference: A pre-construction conference shall be held at least two weeks prior to commencement of field operations to establish procedures to maintain optimum placement conditions for work as specified in this section and to coordinate this work with related and adjacent work. Agenda for meeting shall include mix designs, handling, placing, finishing, and curing the cast-in-place concrete. Pre-construction conference shall include Engineer, Contractor, Ready Mix supplier, concrete finisher, and representative of the synthetic macro fiber manufacturer.
- C. Manufacturer's Representative: A representative of the manufacturer for the synthetic macro fibers shall be notified at least 72 hours prior to project start-up to be available during initial concrete placement.
- D. Trial Mix: Provide a minimum 4 cubic yard (3 cubic meter) trial mix containing proposed concrete design mix to be placed and finished at the job site in location acceptable to the Engineer.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Strux 90/40, Grace Construction Products, W.R. Grace & Co. [www.graceconstruction.com](http://www.graceconstruction.com).
- B. Fibermesh 650, PROPEX Concrete Systems, [www.fibermesh.com](http://www.fibermesh.com).
- C. MasterFiber MAC 100, BASF The Chemical Company, [www.basf-admixtures.com](http://www.basf-admixtures.com).
- D. HPS-650, FRC Industries, [www.frcindustries.com](http://www.frcindustries.com).

### **2.02 MATERIALS**

- A. Synthetic Macro Fiber Reinforcement: Provide synthetic macro fibers complying with the following requirements:
1. Synthetic macro fibers shall meet the requirements of ASTM C 1116.
  2. Synthetic macro fibers shall have a minimum tensile strength of 85 ksi (600 Mpa) .

### **2.03 CONCRETE MIX**

- A. Slab-on-Ground & Topping Applications:
1. Provide Synthetic Macro Fiber Addition Rates as 3.5 lbs/cyd.

### **2.04 MATERIAL STORAGE AND HANDLING**

- A. Fibers shall be supplied in "concrete ready bags", wrapped in moisture-proof packaging and stored in a dry location to prevent exposure to moisture before introduced to concrete mix.

## **PART 3 - EXECUTION**

### **3.01 CONCRETE PLACING, FINISHING, AND CURING**

- A. Fibers can be batched, mixed, pumped, and placed using conventional equipment.
- B. Concrete Finishing: Consult manufacturer for recommendations.
- C. Curing: Comply with ACI 302 "Guide for Concrete Floor and Slab Construction", ACI 308 "Standard Practice for Curing Concrete", ACI 305 "Standard Practice for Hot Weather Concreting" and ACI 306 "Standard Practice for Cold Weather Concreting".
- D. For slabs with Synthetic Macro Fiber Reinforcement, consult manufacturer regarding recommended placement and finishing techniques required to minimize the exposed fibers on the top surface of the slab.

### **3.02 PROTECTION**

- A. Protect completed work from damage and construction operations throughout finishing and curing operations.

**END OF SECTION**

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

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Floors and slabs on grade.
- B. Concrete footings, foundation walls and piers.
- C. Joint devices and accessories associated with concrete work.
- D. Miscellaneous concrete elements, including equipment pads, light pole bases, and flagpole bases.
- E. Column base plate grouting.
- F. Concrete curing.

**1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION:**

- A. Embedded Steel Items: Section 05 50 00 - Metal Fabrications.
- B. Anchor bolts and setting plates: Section 05 12 00 - Structural Steel.

**1.03 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 20 00 - Concrete Reinforcing.
- C. Section 07 92 00 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.
- D. Section 03 24 16 - Synthetic Macro Fiber Reinforcement.

**1.04 REFERENCE STANDARDS**

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- E. ACI 305R - Hot Weather Concreting; 2010.
- F. ACI 306R - Cold Weather Concreting; 2010.
- G. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).
- H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

- K. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- L. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.
- M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- N. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- P. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.
- Q. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- R. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- S. NSF 372 - Drinking Water System Components - Lead Content; 2011.

#### **1.05 SUBMITTALS**

- A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
  - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
  - 2. Anchoring epoxy and expansion anchors.
- B. Mix Designs: Submit 15 days prior to start of work.
  - 1. Submit for each type of concrete specified.
  - 2. Include back-up test data.
  - 3. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
  - 4. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

#### **1.06 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

### **PART 2 PRODUCTS**

#### **2.01 FORMWORK**

- A. Comply with requirements of Section 03 10 00.

#### **2.02 REINFORCEMENT**

- A. Comply with requirements of Section 03 20 00.

## 2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal Portland type.
  - 1. Acquire all cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C 33.
  - 1. Acquire all aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C.
- D. Water: Clean and not detrimental to concrete.

## 2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- G. Accelerating Admixture: ASTM C494/C494M Type C.
- H. Retarding Admixture: ASTM C494/C494M Type B.
- I. Water Reducing Admixture: ASTM C494/C494M Type A.

## 2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
  - 1. Installation: Comply with ASTM E1643.
  - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
  - 3. Products:
    - a. Insulation Solutions, Inc; Viper VaporCheck II 15-mil (Class A): [www.insulationsolutions.com](http://www.insulationsolutions.com).
    - b. Intertape Polymer Group, Inc; VaporMaster 15: [www.intertapepolymer.com](http://www.intertapepolymer.com).
    - c. Stego Industries, LLC: [www.stegoindustries.com](http://www.stegoindustries.com).
    - d. W.R. Meadows, Inc.; PERMINATOR Class A - 15 mils: [www.wrmeadows.com/sle](http://www.wrmeadows.com/sle).
    - e. Raven Industries Inc.; VaporBlock Class A - 15 mils: [www.vaporblock.com](http://www.vaporblock.com).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Board Insulation: Provide at foundation perimeter and under slabs on grade. See Section 07 21 00 - Board and Batt Insulation.

- C. Anchoring Epoxy: Refer to drawings. Acceptable manufacturer's include...
  - 1. Hilti: HIT-RE500-SD injection anchoring system.
  - 2. Simpson Strong-Tie: SET-XP injection anchoring adhesive system.
  - 3. Powers Fasteners: PE 1000+ injection adhesive anchoring system.
- D. Expansion Anchors: Refer to drawings. Acceptable manufacturer's include...
  - 1. Hilti: Kwik Bolt 3 expansion anchor.
  - 2. Simpson Strong-Tie: Strong-Bolt 2 wedge anchor.

## **2.06 BONDING AND JOINTING PRODUCTS**

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
  - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
  - 1. Material: ASTM D1751, cellulose fiber.
- D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
- E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.
- F. Construction Joint Devices: Integral galvanized steel; formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.

## **2.07 CURING MATERIALS**

- A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- B. Water: Potable, not detrimental to concrete.

## **2.08 CONCRETE MIX DESIGN**

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
  - 1. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer. Submit to Architect for review and approval.
- D. Normal Weight Concrete: Type "A".



1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 psi.
  2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
  3. Water-Cement Ratio: Maximum 48 percent by weight.
  4. Total Air Content: 2 percent, determined in accordance with ASTM C 173/C 173M.
  5. Maximum Slump: 4 inches.
  6. Maximum Aggregate Size: 3/4 inch.
  7. Synthetic Macro Fiber Reinforcement: Per drawings.
- E. Normal Weight Concrete: Type "B".
1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 3,000 psi.
  2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
  3. Water-Cement Ratio: Maximum 56 percent by weight.
  4. Total Air Content: 2 percent, determined in accordance with ASTM C 173/C 173M.
  5. Maximum Slump: 4 inches.
  6. Maximum Aggregate Size: 1 inch.
- F. Normal Weight Concrete: Type "D".
1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,500 psi.
  2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
  3. Water-Cement Ratio: Maximum 44 percent by weight.
  4. Total Air Content: 6 percent, determined in accordance with ASTM C 173/C 173M.
  5. Maximum Slump: 4 inches.
  6. Maximum Aggregate Size: 3/4 inch.
- G. Column Base Plate Grout: See 2.05 Concrete Accessories.
- H. For slabs with synthetic fiber reinforcement, consult manufacturer regarding coarse/fine aggregate ratios and admixture recommendations to improve finishability and a smoother finished product.

## **2.09 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

### **3.02 PREPARATION**

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
  2. Use latex bonding agent only for non-load-bearing applications.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and secure in place using approved epoxy.

### **3.03 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect/Engineer not less than 24 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### **3.04 SLAB JOINTING**

- A. Locate joint in center of long direction of the slab/pad.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
- E. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- F. Install joint devices in accordance with manufacturer's instructions.
- G. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- H. Place concrete continuously between predetermined expansion, control, and construction joints.
- I. Do not interrupt successive placement; do not permit cold joints to occur.

### **3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES**

- A. Screed slabs on grade level, maintaining the following minimum F(F) Floor Flatness and F(L) Floor Levelness values when measured in accordance with ASTM E 1155/ASTM E 1155M.
  - 1. F(F): Specified Overall Value (SOV) of 35; Minimum Localized Value (MLV) of 24.
  - 2. F(L): Specified Overall Value (SOV) of 25; Minimum Localized Value (MLV) of 17.
- B. Correct the slab surface if tolerances are less than specified.
- C. Measure F(F) and F(L) in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.
- D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
- E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### **3.06 CONCRETE FINISHING**

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
  - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
  - 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
  - 2. Provide light broom finish on exterior flat work.
  - 3. Provide 3/4" radiused edge on exposed slab edges, unless otherwise noted.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.
- F. For slabs with synthetic fiber reinforcement, consult manufacturer regarding recommended placement and finishing techniques required to minimize the exposed fibers in the top surface of the slab.

### **3.07 CURING AND PROTECTION**

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
  - a. Spraying: Spray water over floor slab areas and maintain wet.
  - b. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
3. Final Curing: Begin after initial curing but before surface is dry.
  - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

### 3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.

### 3.09 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Architect/Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

### 3.10 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

### 3.11 SCHEDULE - CONCRETE TYPES AND FINISHES

Location	Mix Type	Concrete Finish
A. Footings	B	smooth form
B. Foundation walls and piers	B	smooth form
C. Interior slab-on-grade	A	troweled
D. Exterior slab on grade, stoops and aprons	D	broom

**END OF SECTION**

**SECTION 04 20 00  
UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete Block - Base Bid and Alternates.
- B. Clay Facing Brick - for Base Bid and Alternates.
- C. Mortar and Grout.
- D. Reinforcement and Anchorage.
- E. Flashings.
- F. Installation of items furnished under other Sections for embedment in masonry.
- G. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 40 00 - Quality Requirements.
- B. Section 05 50 00 - Metal Fabrications: Loose steel lintels, bearing plates and other miscellaneous metal items for embedment in masonry.
- C. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.
- D. Section 07 84 00 - Firestopping: Firestopping at penetrations of and at joints in masonry work.
- E. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

**1.03 REFERENCE STANDARDS**

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.
- G. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.
- H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

- I. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- K. ASTM C212 - Standard Specification for Structural Clay Facing Tile; 2014.
- L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.
- M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- O. ASTM C476 - Standard Specification for Grout for Masonry; 2010.
- P. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- Q. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.
- R. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- S. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.
- T. Standard Practice for Bracing Masonry Walls Under Construction - Mason Contractors Association of America.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit strap samples of facing brick units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
- B. Source Limitations For Masonry Units: Obtain masonry units of a uniform texture, color and blend (within the range acceptable for each characteristic) through one source from a single manufacturer for each product required.
- C. Source Limitations For Mortar Materials: Obtain mortar components of a uniform quality from one manufacturer for each component and from one source or producer.

- D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- E. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

### **1.07 MOCK-UP**

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, flashings (with lap joint, corner, and end dam), wall insulation, and proposed masonry unit color range, texture, and bond in mock-up.
- B. Locate where directed.
- C. Do not start masonry work until Architect has given written approval of mock-up panel.
- D. Mock-up may remain as part of the Work.

### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Deliver packaged materials in manufacturers' original containers, with labels and markings intact and legible.
- C. Acceptance of Brick Units at Project Site:
  - 1. Remove sample brick units from each pallet and verify conformance with:
    - a. Mock-up: For color and blend.
    - b. Requirements of ASTM C 216.
  - 2. Immediately return pallets producing nonconforming samples to manufacturer for immediate replacement at no cost to Owner.

## **PART 2 PRODUCTS**

### **2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on the drawings for specific locations.
  - 2. Special Shapes: Provide non-standard blocks configured for corners, control joint edges, and other detailed conditions.
    - a. Exterior corners of intersecting walls: Square.
    - b. Corners of window and door jambs: Square.
  - 3. All Units: ASTM C 90, medium or lightweight, at contractor's discretion. Unit Compressive Strength: 2150 psi.
    - a. Both hollow and solid block, as indicated.
    - b. Exposed Faces: Manufacturer's standard color and texture where indicated.

### **2.02 BRICK UNITS**

- A. Manufacturers:

1. Belden Brick Company: [www.beldenbrick.com](http://www.beldenbrick.com).
  2. Glen-Gery Corporation: [www.glengerybrick.com](http://www.glengerybrick.com).
  3. Interstate Brick: [www.interstatebrick.com](http://www.interstatebrick.com).
  4. Sioux City Brick & Tile Co.: [www.siouxcitybrick.com](http://www.siouxcitybrick.com).
- B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Nominal size: Utility and 8 x 8 inch, nominal.
  2. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
  3. Brick Types:
    - a. Type B-1: Utility; match color, texture and range of existing red field brick.
    - b. Type B-2: 8 x 8 inch; match color, texture and range of existing 8 x 8 inch tan brick making up panels above existing windows.
    - c. Note: If color match determined to be unacceptable to Architect and Owner, with Owner the final decision maker, contractor to provide brick staining at Contractor's expense as an acceptable alternative to match color.

### **2.03 MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
1. Hydrated Lime: ASTM C207, Type S.
  2. Mortar Aggregate: ASTM C144.
  3. Grout Aggregate: ASTM C404.
- B. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
1. Colors: As required to match Architect/Engineer's color samples.
- C. Water: Clean and potable.
- D. Admixtures:
1. Air-entraining admixtures or cementitious materials containing air-entraining admixtures are not permitted in mortar.
  2. Anti-freeze compounds or other substances used to lower the freezing point of mortar or grout are not permitted.
  3. Admixtures containing calcium chloride are not permitted.
- E. Accelerating Admixture: Nonchloride type for use in cold weather.
- F. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

### **2.04 REINFORCEMENT AND ANCHORAGE**

- A. Manufacturers:
1. Blok-Lok Limited: [www.blok-lok.com](http://www.blok-lok.com).
  2. Hohmann & Barnard, Inc; 2-Seal Tie: [www.h-b.com/sle](http://www.h-b.com/sle).
  3. WIRE-BOND: [www.wirebond.com](http://www.wirebond.com).
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.



- C. Single Wythe Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
- D. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
- E. Cavity Wall Joint Reinforcement: Ladder type with adjustable ties or tabs spaced at 16 in on center ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B-2; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.
1. Vertical adjustment: Not less than 2 inches.
- F. 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 A 153/A 153M, Class B.
- G. 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. 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 A 153/A 153M, Class B.
- H. Wall Ties: Corrugated formed sheet metal, 7/8 inch wide by 0.05 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.
- I. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.
- J. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
  2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
  3. Vertical adjustment: Not less than 3-1/2 inches.

## 2.05 FLASHINGS

- A. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet complying with ASTM D1970; 40 mils (0.040 inch) minimum total thickness; with cross laminated polyethylene top and bottom surfaces.
- B. Stainless Steel Drip Edge: ASTM A 666, Type 304, soft temper; 26 gage (0.45 mm) thick; finish 2B to 2D; with hemmed edge.

## 2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material conforming to ASTM D2000; 2-5/8 inches wide. Provide with corner and tee accessories, fused joints.
  - 1. Manufacturers:
    - a. Hohmann & Barnard, Inc (including Blok-Lok and Dur-O-Wal brands); Product #RS-Standard or #DA2001: [www.h-b.com](http://www.h-b.com).
    - b. WIRE-BOND; Product #2901: [www.wirebond.com](http://www.wirebond.com).
    - c. Heckmann Building Products, Inc.; Product #352-10: [www.heckmannbuildingprods.com](http://www.heckmannbuildingprods.com).
- B. Joint Filler: Closed cell neoprene; oversized 50 percent to joint width; self expanding; with pressure-sensitive adhesive on one side; 3 inch wide x by maximum lengths available.
  - 1. Manufacturers:
    - a. Hohmann & Barnard, Inc (including Blok-Lok and Dur -O-Wal brands); Product #NSTA or Rapid Expansion Joint DA2015: [www.h-b.com](http://www.h-b.com).
    - b. WIRE-BOND; Product #3300 Expansion Joint : [www.wirebond.com](http://www.wirebond.com).
- C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
  - 1. Full-Height Airspace Maintenance and Drainage Material: Mesh panels, fitted between masonry ties.
    - a. Manufacturers:
      - 1) CavClear/Archovations, Inc; CavClear Polyisocyanurate Insulation System: [www.cavclear.com](http://www.cavclear.com).
  - 2. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
    - a. Manufacturers:
      - 1) Mortar Net Solutions: [www.mortarnet.com](http://www.mortarnet.com).
- D. Termination Bars: Stainless steel or PVC; compatible with flashing membrane, air barrier membrane and associated sealants and adhesives.
- E. Weeps: Molded PVC grilles, insect resistant, sized for full height of head joint for brick being utilized.
  - 1. Manufacturers:
    - a. Blok-Lok Limited: [www.blok-lok.com](http://www.blok-lok.com).
    - b. Hohmann & Barnard, Inc: [www.h-b.com](http://www.h-b.com).
- F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- G. Brick and Split Face Concrete Masonry Sealer: Clear-drying, water-based silicone emulsion.

1. Product: Sure Klean Weather Seal Blok-Guard & Graffiti Control II manufactured by Prosoco, Inc.: [www.prosoco.com](http://www.prosoco.com).

## **2.07 MORTAR AND GROUT MIXES**

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  1. Masonry below grade and in contact with earth: Type M.
  2. Exterior, loadbearing masonry: Type N.
  3. Exterior, non-loadbearing masonry: Type N.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect/Engineer's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C 476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches. Grout strength to be 2500 psi at 28 days.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

## **PART 3 EXECUTION**

### **3.01 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.

### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Temporary Bracing: Provide temporary support and bracing as required for stability, safety and proper performance of masonry during installation of masonry work. Maintain in place until connections and structural elements providing permanent bracing are fully erected and installed and have achieved full strength.
- C. Protection: Cover tops of completed and partially completed walls, projections and sills with waterproof sheeting at the end of each day's work, and maintain protection even when masonry work is not in progress. Extend sheeting minimum 48 inches down both sides of walls and hold sheeting securely in place.
- D. Prevent grout, mortar and soil from staining the face of masonry to be left exposed to view, whether scheduled to be painted or not. Immediately remove grout, mortar and soil that come in contact with such masonry.

### **3.03 COLD AND HOT WEATHER REQUIREMENTS**

- A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

### 3.04 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; provide other joint types where indicated on the Drawings.
- D. Brick Units:
  - 1. Bond: Running.
  - 2. Coursing: Three units and three mortar joints to equal 12 inches.
  - 3. Mortar Joints: Concave; provide raked joints where indicated on the Drawings.

### 3.05 PLACING AND BONDING

- A. Combine concrete masonry units and mortar to achieve a net masonry prism strength (f'm) of 1500 psi.
- B. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- C. Lay hollow masonry units with face shell bedding on head and bed joints.
- D. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- E. Remove excess mortar, mortar droppings and mortar smears as work progresses.
- F. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- G. Interlock intersections and external corners.
- H. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- I. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- J. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- K. Isolate masonry partitions from vertical structural framing members with a control joint.
- L. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.
- M. Build cavity and multi-wythe walls to full thickness shown (adjust cavity space).
- N. Build and verify dimensions for chases and pockets for built-in items according to trade contractor and equipment requirements. Notify Architect of any discrepancies between requirements and drawings.

### **3.06 WEEPS/CAVITY VENTS**

- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
  - 1. Install weeps directly on flashing; ensure that flashing surface beneath weep vents is completely clear of bed joint mortar.

### **3.07 CAVITY MORTAR CONTROL**

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.
- D. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

### **3.08 REINFORCEMENT AND ANCHORAGE - GENERAL**

- A. Unless otherwise indicated on drawings or specified under specific wall type, 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. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches horizontally and 16 inches vertically.

### **3.09 MASONRY FLASHINGS**

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
  - 1. Extend flashings full width at such interruptions and at least 4 inches beyond ends of such interruptions. Turn ends of flashings up at least 4 inches to form end dams, creating a watertight pan.
  - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
  - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Hold back rubberized asphalt flashings 1 inch (min.) from exterior face of masonry. Install drip edge under rubberized asphalt flashings. Install joint sealant at underside of drip edge to prevent moisture migration under flashing.
- C. Lap end joints of flashings 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

### **3.10 LINTELS**

- A. Install loose steel lintels over openings scheduled on the Drawings.

### **3.11 GROUTED COMPONENTS**

- A. Reinforce bond beams with 2, No. 4 bars, 1 inch from bottom web u.n.o.
- B. Lap splices to be as noted on the drawings.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

### **3.12 CONTROL AND EXPANSION JOINTS**

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Run continuous horizontal bond beam reinforcing through control joints unless noted otherwise on drawings.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- D. Size control joint in accordance with Section 07 92 00 for sealant performance.
- E. Form expansion joint as detailed on drawings.
- F. Provide control and expansion joints as indicated on the drawings and at the following locations:
  - 1. Changes in wall height.
  - 2. Changes in wall thickness.
  - 3. Changes in material types.
  - 4. Changes in environmental exposure.
  - 5. Above movement joints in foundations and floors.
  - 6. Below movement joints in roofs and floors.
  - 7. Near one or both sides of door and window openings.
  - 8. At offsets and setbacks.
  - 9. At a maximum horizontal spacing of 25 feet.

### **3.13 BUILT-IN WORK**

- A. As work progresses, install built-in metal door frames, anchor bolts, and plates 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.

- E. Coordinate with trade contractors for elements and openings in walls (plumbing, electrical, ductwork, etc.).

### **3.14 TOLERANCES**

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### **3.15 CUTTING AND FITTING**

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

### **3.16 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Provide free access to masonry operations at project site and cooperate with the appointed firm.

### **3.17 CLEANING**

- A. Remove excess mortar, mortar smears and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

### **3.18 SEALER APPLICATION FOR BRICK MASONRY**

- A. Preparation:
  - 1. Protect surrounding surfaces from product spray, splash and residue.
  - 2. Verify surfaces to be treated are clean, dry and free of contaminants.
  - 3. Verify that joint sealants are complete in place and fully cured.
- B. Application:
  - 1. Test masonry surfaces in inconspicuous locations for suitability and desired results.
  - 2. Do not dilute. Apply to exterior and interior brick and split face concrete masonry surfaces in strict accordance with manufacturer's instructions and at manufacturer's recommended rates for each type of masonry material.

### **3.19 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
- B. Cover tops of completed walls, projections and sills with waterproof sheeting until execution of subsequent portions of the Work provides weather protection for these elements. Extend sheeting minimum 48 inches down both sides and hold sheeting securely in place.
- C. Provide temporary support and bracing as required for stability, safety and proper performance of erected masonry work until connections and structural elements providing permanent bracing are fully erected and installed and have achieved full strength.
- D. Prevent soil and materials from other trades from staining the face of masonry to be left exposed to view, whether scheduled to be painted or not. Immediately remove soil and other foreign materials that come in contact with such masonry.

**END OF SECTION**



**SECTION 04 72 00  
CAST STONE MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Architectural cast stone.
- B. Units required are:
  - 1. Exterior wall units, including sills and accent bands.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 20 00 - Unit Masonry: Installation of cast stone in conjunction with masonry.
- B. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

**1.03 REFERENCE STANDARDS**

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- C. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b (Reapproved 2014).
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- J. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2013.
- K. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2010b.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.
- C. Product Data: Test results of cast stone components made previously by the manufacturer.

- D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- E. Mortar Color Selection Samples.
- F. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.
- G. Source Quality Control Test Reports.
- H. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
  - 1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
  - 2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
  - 3. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
  - 4. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
- B. Mock-Up: Provide full size cast stone components for installation in mock-up of exterior wall.
  - 1. Approved mock-up will become standard for appearance and workmanship.
  - 2. Mock-up may remain as part of the completed work.
  - 3. Remove mock-up not incorporated into the work and dispose of debris.
- C. Source Quality Control: Test compressive strength and absorption of specimens selected at random from plant production.
  - 1. Test in accordance with ASTM C642.
  - 2. Select specimens at rate of 3 per 500 cubic feet, with a minimum of 3 per production week.
  - 3. Submit reports of tests by independent testing agency, showing compliance with requirements.

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

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.

- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Architectural Cast Stone:
1. Any current producer member of the Cast Stone Institute.

### **2.02 ARCHITECTURAL CAST STONE**

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.
1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
  2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
  3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
  4. Color: Match existing stone materials.
  5. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
  2. Unless otherwise indicated on drawings, provide:
    - a. Wash or slope of 1:12 on exterior horizontal surfaces.
    - b. Drips on projecting components, wherever possible.
    - c. Raised fillets at back of sills and at ends to be built in.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
1. Pieces More than 24 inches in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

### **2.03 MATERIALS**

- A. Portland Cement: ASTM C150/C150M.
1. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Admixtures: ASTM C494/C494M.
- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M deformed bars, epoxy coated.
1. Epoxy coated in accordance with ASTM A775/A775M.

- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- I. Mortar: Portland cement-lime, ASTM C270, Type N; do not use masonry cement.
- J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine construction to receive cast stone components. Notify Architect/Engineer if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.
- B. Mechanically anchor cast stone units indicated; set remainder in mortar.
- C. Setting:
  - 1. Drench cast stone components with clear, running water immediately before installation.
  - 2. Set units in a full bed of mortar unless otherwise indicated.
  - 3. Fill vertical joints with mortar.
  - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- D. Joints: Make all joints 3/8 inch, except as otherwise detailed.
  - 1. Rake mortar joints 3/4 inch for pointing.
  - 2. Remove excess mortar from face of stone before pointing joints.
  - 3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
  - 4. Leave the following joints open for sealant:
    - a. Joints in sills and projecting units.
    - b. Joints labeled "expansion joint".
- E. Installation Tolerances:
  - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
  - 2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
  - 3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
  - 4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

F. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.

1. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.
2. Repair methods and results subject to Architect/Engineer 's approval.

### **3.03 CLEANING**

A. Keep cast stone components clean as work progresses. Waiting to clean cast stone until mortar is thoroughly set and cured is not acceptable.

### **3.04 PROTECTION**

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

**END OF SECTION**

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

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

A. Structural steel framing members, support members.

**1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION:**

A. Section 03 30 00 - Cast-In-Place Concrete: Anchor Bolts and Setting Plates.

B. Section 04 20 00 - Unit Masonry: Embedded Steel Items.

**1.03 RELATED REQUIREMENTS**

A. Section 01 40 00 - Quality Requirements.

B. Section 05 31 00 - Steel Decking.

C. Section 05 50 00 - Metal Fabrications.

D. Section 09 90 00 - Paints and Coatings: Finishes applied to ferrous metals.

**1.04 REFERENCE STANDARDS**

A. AISC (MAN) - Steel Construction Manual; 2011.

B. AISC 325-01 - LRFD Manual of Steel Construction; American Institute of Steel Construction, Inc; 2001, Third Edition.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc., 2005.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

I. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

J. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use; 2010.

K. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2014a.

- L. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- M. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- N. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- O. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- P. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.
- Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
  - 2. Connections not detailed.
  - 3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Submit data stating that shop and touch-up primers are compatible with final painting or any special coatings specified. See Section 09 90 00 for finishes applied to ferrous metal surfaces. See Architectural drawings for finish schedule.

### **1.06 QUALITY ASSURANCE**

- A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."
- B. Fabricator: Company specializing in performing the work of this section with minimum 10 years of documented experience.
- C. Fabricator: Company holding the contract for the work of this Section must be a fabricator, not a broker, and must self-perform all the work of this Section.
- D. Erector: Company specializing in performing the work of this section with minimum 10 years of documented experience.
- E. Welder Qualifications: Qualified within previous 12 months in accordance with AWS.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.

- C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- D. Pipe: ASTM A53/A53M, Grade B, Finish black.
- E. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, medium carbon, galvanized, with matching compatible ASTM A563 or A563M nuts and ASTM F436 washers.
- F. High-Strength Structural Bolts: ASTM A490 (ASTM A490M); Type 1 alloy steel, with matching compatible ASTM A563 (ASTM A563M) nuts and ASTM F436 washers.
- G. Unheaded Anchor Rods: ASTM F1554, Grade 36, Galvanized, with matching ASTM A563 or A563M nuts and ASTM F436 Type 1 washers.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- J. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- K. Galvanized steel elements require galvanized bolts, nuts, washers, etc. to be installed.

## **2.02 FABRICATION**

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.
- D. Develop required camber for members.
- E. Provide masonry anchors on all faces of steel elements adjacent to masonry construction.
  - 1. Horizontal spacing to be 24" o.c. Vertical spacing to be 16" o.c. unless noted otherwise.
  - 2. Coordinate locations with architectural drawings.

## **2.03 FINISH**

- A. Prepare structural component surfaces in accordance with SSPC-SP2.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed.
- C. Do not paint top flanges of beams scheduled to receive shear studs.
- D. Structural steel members can remain un-primed in areas concealed from view (i.e. elements concealed in walls, chases, ceilings, etc.) at fabricator's option. Coordinate locations with architectural drawings.
- E. Galvanize exterior exposed structural steel members to comply with ASTM A 123/A 123M. Provide minimum 1.7 oz/sq ft galvanized coating.



## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

### **3.02 ERECTION**

- A. See Section 03 30 00 for installation of anchor rods and setting plates.
- B. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- C. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing and all final connections are complete.
- D. Field weld components and shear studs indicated on drawings and shop drawings.
- E. Install high-strength bolts in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
- F. Do not field cut or alter structural members without approval of Architect/Engineer.
- G. Weld stud shear connectors through steel deck to structural members below.
- H. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

### **3.03 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Provide free access to framing operations at project site and cooperate with the appointed firm.

**END OF SECTION**

**SECTION 05 31 00  
STEEL DECKING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Roof deck.

**1.02 RELATED REQUIREMENTS**

- A. Section 00 14 00 - Quality Requirements.
- B. Section 05 12 00 - Structural Steel.
- C. Section 05 50 00 - Metal Fabrications.
- D. Section 09 90 00 - Paints and Coatings: Finishes applied to steel deck exposed to view.

**1.03 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. 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; 2015.
- C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- E. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.
- F. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Submit data stating that primer is compatible with final painting or any special coatings specified. See Section 09 90 00 for information on finishes applied to ferrous metal surfaces.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 10 years of experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Cut plastic wrap to encourage ventilation.

- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

## **PART 2 PRODUCTS**

### **2.01 STEEL DECK**

- A. Roof Deck: Non-composite type, fluted steel sheet:
  - 1. Ungalvanized Steel Sheet (typical at all roof deck unless noted otherwise) : ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
  - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
  - 3. Structural Properties:
    - a. Span Design: Multiple: Minimum Triple Span.
  - 4. Minimum Metal Thickness, Excluding Finish: gage as indicated on drawings.
  - 5. Nominal Height: 1-1/2 inch.
  - 6. Profile: Fluted; SDI B.
  - 7. Formed Sheet Width: 24 inch.
  - 8. Side Joints: Lapped, mechanically fastened.
  - 9. End Joints: Lapped, welded.

### **2.02 ACCESSORY MATERIALS**

- A. Welding Materials: AWS D1.1/D1.1M.
- B. Fasteners: Galvanized hardened steel, self tapping (#10 TEK minimum).
- C. Shop and Touch-Up Primer: Manufacturer's standard, complying with VOC limitations of authorities having jurisdiction; compatible with scheduled painted finish, coating or fireproofing specified in related Sections.
- D. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

### **2.03 FABRICATED DECK ACCESSORIES**

- A. Sheet Metal Deck Accessories: Metal closure strips, 16 gage (minimum) thick sheet steel; of profile and size as indicated; finished same as deck.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

### **3.02 INSTALLATION**

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch bearing.
- C. On steel supports provide minimum 3 inch bearing.
- D. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods specified.

1. Welding: 5/8" Ø puddle welds as noted on drawings.
- E. At mechanically fastened male/female side laps fasten at 36 inches on center maximum for floor deck. Roof deck sidelaps to be as indicated on the drawings.
- F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
- G. Weld deck in accordance with AWS D1.3/D1.3M.
- H. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.
- I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
- K. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.
- L. Layout deck to achieve minimum 2 span condition for floor decks and 3 span conditions for roof decks unless noted otherwise.

### **3.03 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Provide free access to framing operations at project site and cooperate with the appointed firm.

**END OF SECTION**

**SECTION 05 50 00  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

A. Shop fabricated steel items.

**1.02 RELATED REQUIREMENTS**

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 12 00 - Structural Steel.

D. Section 09 91 13 - Exterior Painting: Paint finish.

**1.03 REFERENCE STANDARDS**

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

F. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

M. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

**1.04 SUBMITTALS**

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
  - 1. Anchoring epoxy and expansion/wedge anchors.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

## **1.05 QUALITY ASSURANCE**

- A. Fabricator: Company holding the contract for the work of this Section must be a fabricator, not a broker, and must self-perform all the work of this Section.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS - STEEL**

- A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.
- D. Plates: ASTM A283.
- E. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- F. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
- G. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction; compatible with scheduled painted finish, coating or fireproofing specified in related Sections.
- J. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction; compatible with scheduled painted finish or coating specified in related Sections.

### **2.02 ACCESSORY MATERIALS**

- A. Anchoring Epoxy: Refer to drawings. Acceptable manufacturer's include...
  - 1. Hilti: HIT-HY-150 fast curing injection system.
  - 2. Simpson Strong-Tie: SET-XP high-strength anchoring adhesive.
  - 3. Powers Fasteners: Pure110+ epoxy injection adhesive anchoring system.

- B. Expansion Anchors: Refer to drawings. Acceptable manufacturer's include...
  - 1. Hilti: Kwik Bolt 3 expansion anchor.
  - 2. Simpson Strong-Tie: Strong-Bolt 2 wedge anchor.

### **2.03 FABRICATION**

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### **2.04 FABRICATED ITEMS**

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; finish as scheduled below.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; finish as scheduled below.
- C. Lintels: As indicated on drawings. Finish as scheduled below.

### **2.05 FINISHES - STEEL**

- A. Prime paint all steel items unless scheduled otherwise at the end of this section.
  - 1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

### **2.06 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.

- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

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

**3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

**3.03 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components where required .
- D. Field weld components indicated on drawings and shop drawings.
- E. Perform field welding in accordance with AWS D1.1/D1.1M.
- F. Obtain approval prior to site cutting or making adjustments not scheduled.
- G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

**3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

**3.05 SCHEDULE**

- A. Exterior Locations and Interior Corrosive Environments Finish
  - 1. Lintels Galvanized
  - 2. Pipe bollards and wheel guards Galvanized
  - 3. Mechanical and electrical equipment rails and supports Galvanized
  - 4. Miscellaneous angles, plates, clips and shims Galvanized
  - 5. Overhead door jambs Galvanized
- B. Interior Locations (Non-Corrosive Environments) Finish
  - 1. Bearing and leveling plates Unpainted



- |   |        |
|---|--------|
| 2. Lintels  | Primed |
| 3. Shelf angles and deck support angles                   | Primed |
| 4. Mechanical and electrical equipment rails and supports | Primed |
| 5. Miscellaneous angles, plates, clips and shims          | Primed |

**END OF SECTION**

**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Rough opening framing for doors, windows, and roof openings.
- B. Sheathing.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Communications and electrical room mounting boards.
- G. Concealed wood blocking, nailers, and supports.
- H. Miscellaneous wood nailers, furring, and grounds.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.
- E. PS 20 - American Softwood Lumber Standard; 2010.
- F. WWPA G-5 - Western Lumber Grading Rules; 2011.

**1.04 DELIVERY, STORAGE, AND HANDLING**

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

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Douglas Fir-Larch, unless otherwise indicated.

2. 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.
  3. 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.

## **2.02 DIMENSION LUMBER**

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  1. Lumber: S4S, No. 2 or Standard Grade.
  2. Boards: Standard or No. 3.

## **2.03 CONSTRUCTION PANELS**

- A. Roof Sheathing: APA PS 1-09, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
  1. Thickness: 1/2 inch, nominal, unless indicated otherwise on Drawings.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

## **2.04 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.

## **2.05 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
  2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWPA standards.
- B. Fire Retardant Treatment:
  1. Exterior Type: AWWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested

in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

- a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
  - b. Do not use treated wood in direct contact with the ground.
2. Interior Type A: AWWA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
- a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
  - b. Treat rough carpentry items as scheduled.
  - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
1. Kiln dry lumber after treatment to maximum moisture content of 15 percent.
  2. Treat lumber in contact with roofing, flashing, or waterproofing.
  3. Treat lumber in contact with masonry or concrete.
  4. Treat lumber less than 18 inches above grade.
  5. Preservative Pressure Treatment of Plywood Above Grade: AWWA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
    - a. Kiln dry plywood after treatment to maximum moisture content of 15 percent.
    - b. Treat plywood in contact with roofing, flashing, or waterproofing.
    - c. Treat plywood in contact with masonry or concrete.
    - d. Treat plywood less than 18 inches above grade.
- D. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Coordinate installation of rough carpentry members specified in other sections.

### **3.02 INSTALLATION - GENERAL**

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

### **3.03 BLOCKING, NAILERS, AND SUPPORTS**

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

### **3.04 ROOF-RELATED CARPENTRY**

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

### **3.05 INSTALLATION OF CONSTRUCTION PANELS**

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing/blocking members, with ends staggered and over firm bearing.
  - 1. Nail panels to framing/blocking; staples are not permitted.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
  - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
  - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
  - 3. Install adjacent boards without gaps.

### **3.06 SITE APPLIED WOOD TREATMENT**

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

### **3.07 TOLERANCES**

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

### **3.08 CLEANING**

- A. Waste Disposal:
  - 1. Comply with applicable regulations.
  - 2. Do not burn scrap on project site.
  - 3. Do not burn scraps that have been pressure treated.
  - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

### **3.09 SCHEDULES**

- A. Roof Blocking: Pressure preservative treated.
- B. Blocking in Fire Rated Walls: Fire retardant treated.
- C. Communications and Electrical Room Mounting Boards: Fire retardant treated.

**END OF SECTION**

**SECTION 06 41 00  
CUSTOM CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Cabinet hardware.
- C. Preparation for installing utilities.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 12 36 00 - Countertops.

**1.03 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, fastening methods, jointing details, and accessories, hardware locations and schedule of finishes.
  - 1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.
  - 2. Provide the information required by AWI/AWMAC/WI (AWS).
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

**1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
  - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Reject and return to fabricator units that are missing hardware components.
- B. Protect units from moisture damage.

## 1.08 FIELD CONDITIONS

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

## PART 2 PRODUCTS

### 2.01 CABINETS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Grade.
- B. Premanufactured Alternative: Subject to compliance with all requirements of this Section, Premanufactured Wood Casework is acceptable for casework components.
- C. Wood Veneer Faced Cabinets: Premium Grade.
  - 1. Exposed Surfaces: HPVA Grade AA, Maple, quarter cut, book-matched.
  - 2. Semi-Exposed Surfaces: HPVA HP-1 Grade A, Maple, plain sliced, random-matched.
  - 3. Concealed Surfaces: HPVA HP-1 Grade B, Maple, plain sliced, random-matched.
- D. Plastic Laminate Faced Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
  - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
  - 3. Finish - Semi-Exposed Surfaces: Decorative laminate.
  - 4. Finish - Concealed Surfaces: Manufacturer's option.
  - 5. Door and Drawer Front Edge Profiles: Radius edge with thick applied band.
  - 6. Door and Drawer Front Retention Profiles: Removable stop.
  - 7. Casework Construction Type: Type A - Frameless.
  - 8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
  - 9. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
    - a. Premium Grade:
      - 1) Provide vertical run and match for doors, drawer fronts and false fronts within each cabinet unit.
      - 2) Provide well-matched doors, drawer fronts and false fronts across multiple cabinet faces in one elevation.
      - 3) Cathedral Grain: Point grain crown up and run in the same direction for entire project.
  - 10. Cabinet Design Series: As indicated on drawings.
  - 11. Adjustable Shelf Loading: 50 lbs. per sq. ft.
    - a. Deflection: L/144.
  - 12. Casework Integrity: Comply with Acceptance Level requirements of AWI/AWMAC/WI (AWS) Appendix A for the following tests.
    - a. Structural Integrity Test - Base Cabinet.
    - b. Concentrated Load Test - Base Cabinet.
    - c. Torsion Test - Base Cabinet.



- d. Structural Integrity Test - Wall Cabinet.
  - e. Door Durability Test.
  - f. Door Impact Test.
  - g. Door Hinge Test.
  - h. Drawer Bottom Impact Test.
  - i. Drawer Support Test.
  - j. Drawer and Door Pull Test.
  - k. Drawer Rolling Load Test.
  - l. Shelf Load Test.
13. Drawer Side Construction: Doweled, Dowel Screwed, Biscuit Splined or Lock Jointed and Nailed.

## 2.02 WOOD-BASED COMPONENTS

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

## 2.03 PANEL MATERIALS

- A. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of cellulosic fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thicknesses as specified under AWI/AWMAC/WI (AWS) Section 10.4.7 for each component type.
  - 1. Use for cabinet and countertop components, including cabinet backs (1/2" min.) and drawer bottoms (1/2" min.), unless another material is indicated on drawings.
  - 2. Use as backing for decorative laminate unless otherwise indicated.
- B. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for dividers, mail slots and other components specifically indicated on drawings.

## 2.04 LAMINATE MATERIALS

- A. Manufacturers:
  - 1. Formica Corporation: [www.formica.com](http://www.formica.com).
  - 2. Lamin-Art, Inc.: [www.laminart.com](http://www.laminart.com).
  - 3. Panolam Industries International, Inc\Nevamar: [www.nevamar.com](http://www.nevamar.com).
  - 4. Wilsonart; \_\_\_\_: [www.wilsonart.com](http://www.wilsonart.com).
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as follows:
  - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
  - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
  - 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
  - 4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.

5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
6. Laminate Backer: BKL, nominal thickness to match that of opposing face sheet, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

## 2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edgebanding: Extruded 3mm PVC or ABS, flat shaped; smooth finish; bonded to edge of component; of width to match component thickness. Provide "flexible" PVC material for curved component edges.
  1. Manufacturers:
    - a. Charter Industries: [www.charterindustries.com](http://www.charterindustries.com).
    - b. EdgeCo, Inc.: [www.edgecoinc.com](http://www.edgecoinc.com).
    - c. Frama-Tech, Inc.: [www.framatech.net](http://www.framatech.net).
  2. Color: Custom, to match selected laminate materials colors.
  3. Use at exposed edges of shelves, cabinet doors, and cabinet drawers.
- C. Fasteners: Size and type to suit application.
- D. 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.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic grommets for cut-outs, consisting of sleeve and flip-top cap, in color to blend with adjacent surface.
  1. Provide one (1) per 6 lineal feet of countertop. Coordinate exact locations in field with Owner.
  2. Product: Doug Mockett & Company, Inc. #EDP3-93D; 2-1/2" Flip-Top Grommet Set in Desert Sand color.

## 2.06 HARDWARE

- A. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
  1. Manufacturer: Knappe & Vogt Manufacturing Company: [www.kv.com](http://www.kv.com).
  2. Standards: #255 ZC zinc coated steel pilaster strips.
  3. Support Clips for Standards: #239 ZC zinc-plated steel.
  4. Pin Supports for drilled holes: #333 ZC zinc-plated steel.
  5. Use for adjustable shelving within cabinet assemblies.
  6. Other acceptable manufacturers:
    - a. John Sterling Company: [www.johnsterling.com](http://www.johnsterling.com).
- B. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, for nominal 1 inch spacing adjustments.
  1. Heavy Duty Standards and Brackets:

- a. Product: #85 standards and #185 brackets manufactured by Knappe & Vogt Manufacturing Company: [www.kv.com](http://www.kv.com).
  - b. Finish: Electroplated, Anachrome.
  - c. Use for wall-attached adjustable shelving
- C. Drawer and Door Pulls: "U" shaped 10 mm dia. steel wire pull, with nickel plated matte finish, 96 mm centers. Provide two (2) pulls for drawers greater than 24 inches wide.
  - 1. Product: \_\_\_\_\_ manufactured by \_\_\_\_\_.
- D. Cabinet Locks: Cam-type to suit door/drawer application, non-captive key operation, steel with chrome finish.
  - 1. Manufacturer:
    - a. CompX International, Inc.: [www.compxnet.com](http://www.compxnet.com).
    - b. Substitutions: Not permitted.
  - 2. Products: CompX Timberline Series.
    - a. Door Locks: 290 Series.
    - b. Drawer Locks: 280 Series.
    - c. Double Door Locks: CompX National, 250 Series, complete with strike plates.
    - d. Locks for Doors Taller Than 48": System 260 Wardrobe Lock.
    - e. Double Door Latch: DL-200 (top mount) and DL-300 (bottom mount).
  - 3. Cam Rotation: 180° CCW turn to unlock; 180° CW turn to lock. Key removable in both locked and unlocked positions.
  - 4. Core Type: Flat key, 5 disc tumbler.
  - 5. Keying: Doors and drawers keyed alike per room and master keyed.
  - 6. Strikes: Provide to match specified lock requirements. Notching or routing of cabinet panel is acceptable where appropriate to the specified lock application/operation.
  - 7. Provide one lock (1) per drawer and one lock (1) per cabinet.
    - a. For paired cabinet doors up to 48" high, provide double door lock lock on right-hand leaf.
    - b. For paired cabinet doors taller than 48" high, provide wardrobe lock on right-hand leaf and double door latches at top and bottom of cabinet to secure left-hand leaf.
  - 8. Provide two keys per lock and 6 master keys.
- E. Drawer Slides:
  - 1. Type: Extension types as scheduled.
  - 2. Static Load Capacity: 100 pounds.
  - 3. Mounting: Side mounted.
  - 4. Features: Provide soft-closing type, with lever disconnect and vertical drawer adjustment.
  - 5. Manufacturers:
    - a. Accuride International, Inc; 3832EC Easy-Close: [www accuride.com](http://www accuride.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Door Hinges: European style concealed self-closing type, steel with satin finish, allowing 3-dimensional adjustment. Provide complete with black plastic cover caps, and manufacturer's recommended mounting plates with dowel inserts and fasteners.
  - 1. Manufacturers:
    - a. Grass America Inc. 165 Degree Snap On 3000 Series: [www.grassusa.com](http://www.grassusa.com).

- b. Hardware Resources 170 Degree Basic Clip On with Dowels #248.0M73.05: [www.hardwareresources.com](http://www.hardwareresources.com).
- c. Hettich America, LP; \_\_\_\_\_: [www.hettich.com/sle](http://www.hettich.com/sle).
- d. Blum, IncCLIP top 170° Press-in #71T6580: [www.blum.com](http://www.blum.com).
- e. Substitutions: Not permitted.

## **2.07 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.
  - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
  - 2. Cap exposed plastic laminate finish edges with plastic trim.
- E. Provide cutouts for fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

## **2.08 SHOP FINISHING**

- A. Hardware: Install hardware components in fabricator's shop. Carpenter installation of cabinet hardware components in field is not permitted.
- B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 11, Polyurethane, Catalyzed.
    - b. Stain: As selected by Architect/Engineer.
    - c. Sheen: Satin.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.

### **3.03 ADJUSTING**

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.
- C. Repair damaged and defective casework to eliminate defects functionally and visually. Where not possible to repair properly, replace casework.

### **3.04 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.
- B. Remove sawdust, leftover materials and other debris from within cabinets and drawers.

**END OF SECTION**

**SECTION 07 21 00  
THERMAL INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Board insulation at cavity wall construction, perimeter foundation wall, and underside of floor slabs.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers: Separate air barrier and vapor retarder materials.
- B. Section 07 53 00 - Elastomeric Membrane Roofing: Roofing insulation.
- C. Section 07 84 00 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- D. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

**1.03 REFERENCE STANDARDS**

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

**1.05 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

**PART 2 PRODUCTS**

**2.01 APPLICATIONS**

- A. Insulation Under Concrete Slabs: Extruded polystyrene board.

- B. Insulation at Perimeter of Foundation: Extruded polystyrene board.
- C. Insulation Inside Masonry Cavity Walls: Extruded polystyrene board.

## 2.02 FOAM BOARD INSULATION MATERIALS

### A. Board Insulation at Foundation Perimeter:

1. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
  - a. Type: ASTM C578, Type IV (vertically, at foundation wall surface).
  - b. Type: ASTM C578, Type VII (horizontally, under slab surface).
  - c. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
  - d. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - e. R-value; 1 inch of material at 72 degrees F: 5, minimum.
  - f. Board Thickness: 2 inches unless indicated otherwise on drawings.
  - g. Board Edges: Square.
  - h. Water Absorption, Maximum: 0.3 percent, by volume.
  - i. Manufacturers:
    - 1) Dow Chemical Company; \_\_\_\_\_: [www.dow.com](http://www.dow.com).
    - 2) Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).

### B. Board Insulation at Cavity Walls:

1. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
  - a. Type: ASTM C578, Type IV.
  - b. Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.
  - c. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
  - d. R-value; 1 inch of material at 72 degrees F: 5, minimum.
  - e. Board Thickness: 3 inches unless indicated otherwise on drawings.
  - f. Board Edges: Square.
  - g. Water Absorption, maximum: 0.3 percent, volume.
  - h. Manufacturers:
    - 1) Dow Chemical Co: [www.dow.com](http://www.dow.com).
    - 2) Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
    - 3) Substitutions: See Section 01 60 00 - Product Requirements.

## 2.03 BATT INSULATION MATERIALS

### A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
4. Formaldehyde Content: Zero.
5. Manufacturers:
  - a. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - b. Johns Manville: [www.jm.com](http://www.jm.com).
  - c. Owens Corning Corporation: [www.ocbuildingspec.com/sle](http://www.ocbuildingspec.com/sle).

## **2.04 ACCESSORIES**

- A. Adhesive: Type recommended by insulation manufacturer for application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of irregularities.

### **3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER**

- A. Apply adhesive to back of boards:
  - 1. Three continuous beads per board length.
  - 2. Full bed 1/8 inch thick.
- B. Install boards horizontally on foundation perimeter.
  - 1. Place boards to maximize adhesive contact.
  - 2. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### **3.03 BOARD INSTALLATION AT CAVITY WALLS**

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
  - 1. Install in running bond pattern.
  - 2. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### **3.04 BOARD INSTALLATION UNDER CONCRETE SLABS**

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

### **3.05 BATT INSTALLATION**

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.



### **3.06 PROTECTION**

A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

**SECTION 07 25 00  
WEATHER BARRIERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Air Barriers: Materials to stop passage of air and water through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 53 00 - Elastomeric Membrane Roofing: Vapor retarder installed as part of roofing system.
- C. Section 07 90 05 - Joint Sealers: Sealant materials and installation techniques.

**1.03 DEFINITIONS**

- A. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

**1.04 REFERENCE STANDARDS**

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- E. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; ICC Evaluation Service, Inc; 2011.
- F. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc; 2015.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

- E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.
- F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

## **1.06 QUALITY ASSURANCE**

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); [www.airbarrier.org/sle](http://www.airbarrier.org/sle):
  - 1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
  - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

## **1.07 MOCK-UP**

- A. Install air barrier materials in mock-up specified in Section 04 20 00.

## **1.08 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

## **PART 2 PRODUCTS**

### **2.01 WEATHER BARRIER ASSEMBLIES**

- A. Air Barrier:
  - 1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating.

### **2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)**

- A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.
- B. Air Barrier Coating: Fluid-applied, vapor permeable, elastomeric waterproofing membrane.
  - 1. Material: Acrylic.
  - 2. Acceptable Substrates: Stated by manufacturer as suitable for installation on visibly damp surfaces and concrete that has hardened but is not fully cured ("green" concrete) without requiring a primer.
  - 3. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
  - 4. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
  - 5. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 4 months weather exposure after application.
  - 6. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.

7. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
8. VOC Content: 100 g per L or less.
9. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.
10. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
11. Products:
  - a. Grace Construction Products; Perm-A-Barrier VP or Perm-A-Barrier VPO: [www.na.graceconstruction.com](http://www.na.graceconstruction.com).
  - b. Master Wall, Inc.; Rollershield LAB System: [www.masterwall.com/sle](http://www.masterwall.com/sle).
  - c. PROSOCO, Inc; R-GUARD Spray Wrap MVP: [www.prosoco.com](http://www.prosoco.com).
  - d. Sto Corp; Sto Gold Coat: [www.stocorp.com/sle](http://www.stocorp.com/sle).
  - e. Rubber Polymer Corporation; Rub-R-Wall Airtight VP: [www.rpcinfo.com](http://www.rpcinfo.com).
  - f. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.03 ACCESSORIES**

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
- C. Flexible Flashing: Sheathing fabric saturated with air barrier coating and complying with the applicable requirements of ICC-ES AC148.
- D. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
  1. Products:
    - a. Master Wall Inc; SuperiorFlash: [www.masterwall.com/sle](http://www.masterwall.com/sle).
- E. Thinners and Cleaners: As recommended by material manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept the work of this section.

### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Coatings:
  1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.

2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
  3. Use flashing to seal to adjacent construction and to bridge joints.
- D. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches wide; do not seal sill flange.
  3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
  4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
  5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
  6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Coordination of ABAA Tests and Inspections:
1. Provide testing and inspection required by ABAA QAP.
  2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
  3. Cooperate with ABAA testing agency.
  4. Allow access to air barrier work areas and staging.
  5. Do not cover air barrier work until tested, inspected, and accepted.
- C. Do not cover installed weather barriers until required inspections have been completed.
- D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- E. Take digital photographs of each portion of the installation prior to covering up.

### **3.05 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**

**SECTION 07 53 00**  
**ELASTOMERIC MEMBRANE ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Elastomeric roofing membrane, adhered conventional application.
- B. Insulation, flat and tapered.
- C. Vapor retarder.
- D. Flashings.
- E. Roofing stack boots and walkway pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashings and counterflashings.
- B. Section 07 71 00 - Roof Specialties: roof portals.

**1.03 REFERENCE STANDARDS**

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).
- B. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).
- C. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.
- D. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).
- E. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- G. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011.
- H. FM DS 1-28 - Wind Design; 2007.
- I. FM DS 1-29 - Property Loss Prevention Data Sheet - Roof Deck Securement and Above-Deck Roof Components, February 2007 edition.
- J. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.
- K. UL (DIR) - Online Certifications Directory; current listings at [database.ul.com](http://database.ul.com).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of associated counterflashings installed under other sections.

- B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.
- D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, special procedures, and perimeter conditions requiring special attention.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Perform work in accordance with NRCA ML104 and manufacturer's instructions.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience, and approved by manufacturer.
  - 1. Having achieved at least one of the following certifications/recognitions by the manufacturer:
    - a. Carlisle "Centurion" status.
    - b. Carlisle "Hall of Fame" status.
    - c. Firestone "Master Contractor" status for the current year and a current annual "Quality Incidence Rating" of 2.0 or less.

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

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.

#### **1.08 FIELD CONDITIONS**

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 95 degrees F.

- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

## **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide manufacturer's extended fifteen (15) year "total roof system" material and labor warranty to cover failure to prevent penetration of water. Include entire roof system, from top of roof decking to top of roofing membrane, including associated metal flashings and counterflashings.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. EPDM Membrane Materials:
  - 1. Carlisle Roofing Systems, Inc: [www.carlisle-syntec.com](http://www.carlisle-syntec.com).
  - 2. Firestone Building Products, LLC: [www.firestonebpc.com](http://www.firestonebpc.com).
  - 3. Substitutions: Not permitted.
- B. Insulation:
  - 1. Same manufacturer as Membrane Materials, for inclusion in total system warranty.

### **2.02 ROOFING - UNBALLASTED APPLICATIONS**

- A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.
- B. Roofing Assembly Requirements:
  - 1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.
    - a. Calculate SRI in accordance with ASTM E1980.
    - b. Field applied coating may not be used to achieve specified SRI.
  - 2. Roof Covering External Fire Resistance Classification: UL (DIR) certified Class A.
  - 3. Factory Mutual Classification: Class I and windstorm resistance of I-90, in accordance with FM DS 1-28.
  - 4. Securement of Roofing Components: As prescribed in FM DS 1-29.
- C. Acceptable Insulation Types - Constant Thickness Application:
  - 1. Minimum 2 layers of polyisocyanurate board.
- D. Acceptable Insulation Types - Tapered Application:
  - 1. Tapered polyisocyanurate board.

### **2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS**

- A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); non-reinforced; complying with minimum properties of ASTM D4637.



1. Thickness: 0.060 inch.
  2. Sheet Width: 200 inch, minimum; factory-fabricate into largest sheets possible.
  3. Color: White.
  4. Tensile Strength: 1,300 psi, measured in accordance with ASTM D412.
  5. Ultimate Elongation: 300 percent, measured in accordance with ASTM D412.
  6. Hardness: 65 +/-10, measured in accordance with ASTM D2240, using Type A durometer.
  7. Tear Strength: 150 lbf/in, measured in accordance with ASTM D624.
  8. Water Vapor Permeability: 2.0 perm inch, measured in accordance with ASTM E96/E96M.
  9. Brittleness Temperature: -49 degrees F, measured in accordance with ASTM D746.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Vapor Retarder: Plastic, complying with requirements of fire rating classification; compatible with roofing and insulation materials.
1. Fire-retardant adhesive.
  2. Vapor permeability: Not more than 0.06 perms, measured in accordance with ASTM E 96/E 96M.
- D. Flexible Flashing Material: Same material as membrane.

#### **2.04 INSULATION**

- A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 2 and with the following characteristics:
1. Compressive Strength: 16 psi
  2. Board Size:
    - a. Loose-Laid, Mechanically Attached Applications: 48 x 96 inches.
    - b. Fully Adhered Applications: 48 x 48 inches.
  3. Maximum Board Thickness: 3 inches.
  4. Long-Term Thermal Resistance: R-value of 5.7 (min.) per inch of thickness.
  5. Board Edges: Square.

#### **2.05 ACCESSORIES**

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Insulation Fasteners: Appropriate for purpose intended and approved by Factory Mutual and roofing manufacturer.
- C. Insulation Adhesive: Low-rise polyurethane foam type; approved by insulation manufacturer.
- D. Membrane Adhesive: As recommended by membrane manufacturer.
- E. Insulation Adhesive: As recommended by insulation manufacturer.
- F. Walkway Pads: Suitable for maintenance traffic.
1. Composition: Recycled rubber.
  2. Size: 24 x 24 x 2 inch; 42 lbs. per paver.
  3. Surface Color: Charcoal Gray.
  4. Product: RubberForm Recycled Products, LLC; Rubber Rooftop Pavers: [www.rubberform.com](http://www.rubberform.com).

- a. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

### **3.02 VAPOR RETARDER AND INSULATION - UNDER MEMBRANE**

- A. Apply vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
  - 1. Extend vapor retarder under perimeter blocking, past deck edge, up backside face of parapets and under parapet top blocking.
  - 2. Extend vapor retarder up outside faces of roof curbs to level of top surface of roof insulation. Seal top edge of vapor retarder to roof curb surfaces.
  - 3. Seal vapor retarder to roof drain bodies and to other roof deck penetrations.
- B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
- C. Attachment of Insulation:
  - 1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.
  - 2. Embed second layer of insulation into full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.
- D. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.
- E. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- F. On metal deck, place boards perpendicular to flutes with insulation board edges bearing on deck flutes.
- G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- H. Do not apply more insulation than can be covered with membrane in same day.

### **3.03 MEMBRANE APPLICATION**

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.

- C. Fully Adhered Application: Apply adhesive to substrate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
  - 1. Secure flexible flashing attachment strip to nailing strips at 4 inches on center.
  - 2. Extend membrane over flexible flashing and nailing strips and up a minimum of 12 inches onto vertical surfaces. Continue membrane past tops of parapets and lip membrane over tops of parapets so that membrane extends a minimum of 1 inch down past bottom of roof blocking on exterior faces of parapets.
  - 3. Fully adhere membrane to flexible flashing attachment strip.
  - 4. Install in accordance with NRCA Detail Plate TS-1.
- F. At gravel stops and roof edge flashings, extend membrane under gravel stop and onto the outside face of the wall, then strip in gravel stop or roof edge flashing with flexible flashing.
  - 1. Install in accordance with NRCA Detail Plate TS-3 or TS-3A.
- G. Around roof penetrations, seal flanges and flashings with flexible flashing, or provide boot specified in Section 07 71 00.
  - 1. Install in accordance with NRCA Detail Plate TS-18 or TS-18A.
- H. Coordinate installation of associated counterflashings installed under other sections.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Require site attendance of roofing material manufacturer at mobilization and upon completion of the Work.

### **3.05 CLEANING**

- A. Remove bituminous markings from finished surfaces.
- B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- C. Repair or replace defaced or damaged finishes caused by work of this section.

### **3.06 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION**

**SECTION 07 62 00**  
**SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and scuppers and conductor heads.
- B. Sealants for joints within sheet metal fabrications.
- C. Precast concrete splash pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 07 31 13 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.
- C. Section 07 71 23 - Manufactured Gutters and Downspouts.
- D. Section 07 90 05 - Joint Sealers.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- E. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).
- F. CDA A4050 - Copper in Architecture - Handbook; current edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

**1.04 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

## **PART 2 PRODUCTS**

### **2.01 SHEET MATERIALS**

- A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage (0.032 inch) thick unless scheduled otherwise in this Section or indicated otherwise on the Drawings; plain finish shop pre-coated with fluoropolymer coating.
  - 1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
  - 2. Color: Match existing.

### **2.02 ACCESSORIES**

- A. Fasteners: Same material and finish as flashing metal .
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Asphaltic mastic, ASTM D 4479 Type I.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

### **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, minimum 3 inches wide, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip, except where indicated otherwise on Drawings.

### **2.04 DOWNSPOUT FABRICATION**

- A. Downspouts: Rectangular profile.
- B. Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
- C. Accessories: Profiled to suit gutters and downspouts.
  - 1. Anchorage Devices: In accordance with SMACNA requirements.
  - 2. Gutter Supports: Brackets.
  - 3. Downspout Supports: Brackets.

- D. Splash Pads: Precast concrete type, 30 x 12 x 3 inches; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### **3.03 INSTALLATION**

- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- B. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- C. Seal metal joints watertight.
- D. Secure downspouts in place using concealed fasteners.
- E. Set splash pads under downspouts.

### **3.04 SCHEDULE**

- A. Primary Drainage Scuppers, Conductor Heads and Downspouts:
  - 1. Material: Pre-Finished Aluminum.
  - 2. Thickness: 0.032 inch.
  - 3. Finish: Fluoropolymer Coating.
  - 4. Drawing Detail: SMACNA (ASMM) Figure 1-26.
- B. Coping, Cap, Parapet, Sill and Ledge Flashings:
  - 1. Material: Pre-Finished Aluminum.
  - 2. Thickness: 0.050 inch.
  - 3. Finish: Fluoropolymer Coating.

**END OF SECTION**

**SECTION 07 71 00  
ROOF SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Prefabricated roof specialties, including pipe/stack boots and roof portals.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 53 00 - Elastomeric Membrane Roofing.

**1.03 REFERENCE STANDARDS**

- A. NAAMM (MFM) - Metal Finishes Manual; National Association of Architectural Metal Manufacturers; 1988.
- B. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Pipe and Penetration Flashings:
  - 1. Conn-Fab Sales, Inc.: [www.connfab.com](http://www.connfab.com).
  - 2. The Pate Company: [www.patecurbs.com](http://www.patecurbs.com).
  - 3. Portals Plus: [www.portalsplus.com](http://www.portalsplus.com).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

**2.02 COMPONENTS**

- A. Pipe/Stack Boots: EPDM material, conically stepped shape.
  - 1. Adapters: Manufacturer's standard molded EPDM rubber, appropriate to the size and shape of the penetration.
  - 2. Clamps: Stainless steel pipe clamping rings for securing cap(s) and adapters around penetration(s).
- B. Prefabricated Roof Portal Systems: Consisting of a circular metal base flashing and a rubber cap.
  - 1. Base Flashing: Circular, unitized spun aluminum, with a double bead weatherseal at opening collar accept manufacturer's standard molded rubber cap, forming a wetherproof seal with additional clamps or sealant.

- a. Diameter: Suitable to penetration(s) to be flashed.
- b. Height: Sufficient to maintain roofing system warranty.
2. Cap: Molded EPDM rubber sized to fit base flashing, with molded weatherseal grooves to fit weatherseal beads on base flashing collar. Provide manufacturer's standard cap(s) and adapters of the appropriate size and shape to properly seal penetration(s).
3. Clamp(s): Stainless steel pipe clamping rings for securing cap(s) and adapters around penetration(s).

### **2.03 ACCESSORIES**

- A. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

### **3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Conform to drawing details included in NAAMM, NRCA and SMACNA manuals.
- E. Coordinate installation of components of this section with installation of stacks, vents, piping, conduits and other items penetrating roof membrane.
- F. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- G. Coordinate installation of sealants with work of this section to ensure water tightness.

**END OF SECTION**



**SECTION 07 84 00  
FIRESTOPPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.
- C. Smoke-stopping of all penetrations of and joints in smoke partitions, whether indicated on drawings or not, and other openings indicated.

**1.02 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.
- C. ITS (DIR) - Directory of Listed Products; current edition.
- D. FM 4991 - Approval Standard for Firestop Contractors; 2013.
- E. FM (AG) - FM Approval Guide; current edition.
- F. UL (FRD) - Fire Resistance Directory; current edition.

**1.03 DEFINITIONS**

- A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
- B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
- C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire gasses and smoke.
- D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
- E. Joint: Interruption to a fire-rated assembly occurring at interface between 1) adjacent sections of wall, 2) intersecting walls, 3) top of wall and ceiling, structural floor or roof deck, 4) wall and edge of structural floor, 5) adjacent sections of structural floor.
- F. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations and joints.
- G. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

#### **1.04 SYSTEM DESCRIPTION**

A. Design Requirements:

1. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
1. Provide manufacturer's qualified engineering judgements for non-standard applicaitons.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

#### **1.06 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
  2. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
  2. With minimum 3 years documented experience installing work of this type.
  3. Able to show at least 5 satisfactorily completed projects of comparable size and type.
  4. Licensed by authority having jurisdiction.

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

- A. Deliver products in original, unopened packaging with legible manufacturer's identification.
- B. Coordinate delivery with scheduled installation date to minimize storage time at site.
- C. Store materials in a clean, dry, ventilated location. Protect materials from freezing if required by manufacturer.

## **1.08 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

## **PART 2 PRODUCTS**

### **2.01 FIRESTOPPING - GENERAL REQUIREMENTS**

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

### **2.02 FIRESTOPPING SYSTEMS**

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814 or ASTM E119 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
- B. Acceptable Manufacturers: As listed in UL (FRD) for specific UL Design Number.
- C. Fill, Void or Cavity Materials: Conform to UL (FRD) - XHHW.
- D. Firestop Devices: Conform to UL (FRD) - XHJI.
- E. Forming Materials: Conform to UL (FRD) - XHKU.
- F. Mechanical Joint Assemblies: Conform to UL (FRD) - XHLP.
- G. Packing Material: As required by specific UL Design Number for joint system or through-penetration firestop system.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.
  - 1. Verify barrier joints and penetrations are properly sized and in suitable condition for application of materials.

### **3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

### **3.03 INSTALLATION**

- A. Install materials in manner described in UL (FRD) or fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

**3.04 CLEANING**

A. Clean adjacent surfaces of firestopping materials.

**3.05 PROTECTION**

A. Protect adjacent surfaces from damage by material installation.

B. Patch or replace firestopping damaged by work of other sections.

**END OF SECTION**

## **SECTION 07 92 00 JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

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

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- B. Section 07 84 00 - Firestopping: Firestopping sealants.
- C. Section 08 63 00 - Metal-Framed Skylights: Structural and weatherseal sealants and accessories.
- D. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.
- E. Section 08 80 00 - Glazing: Glazing sealants and accessories.
- F. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- G. Section 23 31 00 - HVAC Ducts and Casings: Duct sealants.

#### **1.03 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; 2014.
- 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; 2013.
- G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
- H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.
- I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).
- J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

## 1.04 SUBMITTALS

- A. See Section 01 30 00 - 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.
- 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/Engineer 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.
- G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- H. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
  - 1. Adhesion Testing: In accordance with ASTM C794.
  - 2. Compatibility Testing: In accordance with ASTM C1087.
  - 3. Allow sufficient time for testing to avoid delaying the work.
  - 4. Deliver to manufacturer sufficient samples for testing.

5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
  6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
1. Identification of testing agency.
  2. Name(s) of sealant manufacturers' field representatives who will be observing
  3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    - a. Test date.
    - b. Copy of test method documents.
    - c. Age of sealant upon date of testing.
    - d. Test results, modeled after the sample form in the test method document.
    - e. Indicate use of photographic record of test.
- E. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
  2. Have a copy of the test method document available during tests.
  3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
  4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
  5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
  6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect/Engineer.
- F. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inch long.
  2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
  3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
- G. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

## **1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.

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

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

### **2.02 JOINT SEALANT APPLICATIONS**

#### **A. Scope:**

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
  - a. Wall expansion and control joints.
  - b. Joints between door, window, and other frames and adjacent construction.
  - c. Joints between different exposed materials.
  - d. Openings below ledge angles in masonry.
  - e. Lap joints in sheet metal flashing..
  - f. Other joints indicated below.
2. 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. Joints between countertop back and side splashes and adjacent wall construction.
  - c. Joints between window sills and adjacent window and wall construction.
  - d. Joints between plumbing fixtures and adjacent construction.
  - e. Other joints indicated below.
3. Do not seal the following types of joints.
  - a. Intentional weep holes in masonry.
  - b. Weep holes in curtain wall, storefront and window systems.
  - c. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
  - d. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
  - e. Joints where installation of sealant is specified in another section.
  - f. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, Type S-1, unless otherwise indicated.

C. Interior Joints: Use non-sag polyurethane sealant, Type S-3, unless otherwise indicated.

1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant; Type S-4.
2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; clear; Type S-2.
3. Floor Joints: Self-leveling polyurethane "traffic-grade" sealant; Type S-5.

D. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.



## 2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

## 2.04 NONSAG JOINT SEALANTS

- A. Type S-1 - 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 and 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.
- B. Type S-2 - 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.
- C. Type S-3 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
- D. Type S-4 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

## 2.05 SELF-LEVELING SEALANTS

- A. Type S-5 - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
  - 1. Composition: Multi-component, 100 percent solids by weight.
  - 2. Hardness: Minimum of 85 (Shore A) or 35 (Shore D), when tested in accordance with ASTM D2240 after 7 days.
  - 3. Color: Concrete gray.
  - 4. Joint Width, Minimum: 1/8 inch.
  - 5. Joint Width, Maximum: 1/4 inch.
  - 6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.

## 2.06 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.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location shown in the test plan.
  - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
  - 2. Notify Architect/Engineer of date and time that tests will be performed, at least 7 days in advance.
  - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
  - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
  - 5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect/Engineer.
  - 6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- 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.

### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. 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.

#### **3.04 FIELD QUALITY CONTROL**

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect/Engineer immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- D. Repair destructive test location damage immediately after evaluation and recording of results.

#### **3.05 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 the low temperature in the thermal cycle. Report failures immediately and repair.

**END OF SECTION**

**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 13 - Exterior Painting: Field painting.
- D. Section 09 91 23 - Interior Painting: Field painting.

**1.03 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); 2014.
- 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; 2015.
- 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; 2015.
- 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; 2014.
- H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- J. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

- K. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- L. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

#### **1.05 QUALITY ASSURANCE**

- A. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes installation requirements.

#### **1.06 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.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Hollow Metal Doors and Frames:
  - 1. Ceco Door, an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 2. Republic Doors: [www.republicdoor.com](http://www.republicdoor.com).
  - 3. Steelcraft, an Allegion brand: [www.allegion.com/sle](http://www.allegion.com/sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 DESIGN CRITERIA**

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 3. Door Edge Profile: Hinged edge square, and lock edge beveled.
  - 4. Typical Door Face Sheets: Flush.
  - 5. Glazed Lights: Non-removable stops on non-secured side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.

6. 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.
  7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) 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 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) 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.

### **2.03 HOLLOW METAL DOORS**

- A. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 1 - Standard-duty.
    - b. Physical Performance Level C, 250,000 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. Face Sheet Gage: In accordance with specified Grade unless scheduled otherwise on drawings.
  3. Core: Polyurethane foam.
  4. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
  5. Door Thickness: 1-3/4 inch, nominal.
  6. Top/Bottom Closures : Flush with top/bottom of faces and edges.
  7. Weatherstripping: Refer to Section 08 71 00.
  8. Door Finish: Factory primed and field finished.

### **2.04 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
  2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
  3. Frame Finish: Factory primed and field finished.
  4. Weatherstripping: Separate, see Section 08 71 00.
- C. Interior Door Frames, Non-Fire Rated: Face welded type.
1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
  2. Frame Finish: Factory primed and field finished.

- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- F. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

## **2.05 ACCESSORIES**

- A. Glazing: As specified in Section 08 80 00.
- B. Removable Stops: Formed sheet steel, butted corners; prepared for countersink style tamper proof screws.
- C. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## **2.06 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.

## **PART 3 EXECUTION**

### **3.01 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.

### **3.02 PREPARATION**

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

### **3.03 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. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

- D. Coordinate installation of hardware.
- E. Coordinate installation of glazing.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Touch up damaged factory finishes.

#### **3.04 TOLERANCES**

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

#### **3.05 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

#### **3.06 SCHEDULE**

- A. Refer to Door and Frame Schedule on the Drawings.

**END OF SECTION**



**SECTION 08 14 16  
FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - 1. Provide the information required by AWI/AWMAC/WI (AWS).
- D. Specimen warranty.
- E. Samples: Submit two samples of door veneer, 8 x 10 inch in size illustrating wood grain, stain color, and sheen.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

**1.05 QUALITY ASSURANCE**

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

**1.06 DELIVERY, STORAGE, AND HANDLING**

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

## **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
  - 1. Eggers Industries: [www.eggersindustries.com](http://www.eggersindustries.com).
  - 2. Graham Wood Doors: [www.grahamdoors.com](http://www.grahamdoors.com).
  - 3. VT Industries, Inc: [www.vtindustries.com](http://www.vtindustries.com).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 DOORS**

- A. Doors: See drawings for locations and additional requirements.
  - 1. Quality Level: Grade as indicated on drawings, Extra Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS).
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.

### **2.03 DOOR AND PANEL CORES**

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

### **2.04 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
  - 1. Vertical Edges: Any option allowed by quality standard for grade.
  - 2. "Running Match" each pair of doors and doors in close proximity to each other.
  - 3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

### **2.05 ACCESSORIES**

- A. Hollow Metal Door Frames: As specified in Section 08 11 13.
- B. Glazed Openings:
  - 1. Heat-Strengthened and Fully Tempered Glass: 1.
  - 2. Glazing: Single vision units, 1/4 inch glass.
  - 3. Tint: Clear.

- C. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.
- D. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.
- E. Door Hardware: As specified in Section 08 71 00.

## **2.06 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Provide solid blocks at lock edge for hardware reinforcement.
  - 1. Provide solid blocking for other throughbolted hardware.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

## **2.07 FACTORY FINISHING - WOOD VENEER DOORS**

- A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 2, Lacquer, Precatalyzed.
    - b. Stain: As selected by Architect/Engineer.
    - c. Sheen: Satin.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

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

### **3.03 TOLERANCES**

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

### **3.04 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

### **3.05 SCHEDULE**

- A. Refer to Door and Frame Schedule on the Drawings.

**END OF SECTION**

**SECTION 08 36 13**  
**SECTIONAL OVERHEAD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Alternate No. 1:
  - 1. Overhead sectional doors, electrically operated.
  - 2. Operating hardware and supports.
  - 3. Electrical controls.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Steel channel opening frame.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 26 05 34 - Conduit: Conduit from electric circuit to operator and from operator to control station.
- D. Section 26 05 34 - Conduit: Empty conduit from control units to door operator.
- E. Section 26 27 17 - Equipment Wiring.

**1.03 REFERENCE STANDARDS**

- A. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- B. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.
- C. NEMA MG 1 - Motors and Generators; 2014.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.04 SUBMITTALS**

- A. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- B. Product Data: Show component construction, anchorage method, and hardware.
- C. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- D. Operation Data: Include normal operation, troubleshooting, and adjusting.
- E. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
- C. Conform to applicable code for motor and motor control requirements.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified.

## 1.06 SPECIAL WARRANTY

- A. Provide manufacturer's extended warranty to correct defective Work within a five year period after Date of Substantial Completion.
  - 1. Include coverage for electric motor and transmission.
  - 2. Provide five year manufacturer's extended warranty for electric operating equipment.
- B. List Manufacturer's Extended Warranty as a separate line item on Schedule of Values.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Sectional Doors - Basis of Design: Overhead Door Corporation; Thermacore Model 592: [www.overheaddoor.com](http://www.overheaddoor.com).
- B. Other Acceptable Manufacturers:
  - 1. C.H.I. Overhead Doors; Model 3212 Micro-Grooved Sandwich Steel Insulated Doors: [www.chiohd.com](http://www.chiohd.com).
  - 2. Clopay Corporation; Energy Series With Intellicore Model 3722: [www.clopaydoor.com](http://www.clopaydoor.com).
  - 3. Haas Door Company, Model 2033: [www.haasdoor.com](http://www.haasdoor.com).
  - 4. Overhead Door Corporation; Thermacore Model 592: [www.overheaddoor.com](http://www.overheaddoor.com).
  - 5. Wayne-Dalton, a Division of Overhead Door Corporation; Thermospan 200-20: [www.wayne-dalton.com](http://www.wayne-dalton.com).

### 2.02 STEEL DOOR COMPONENTS

- A. Steel Doors: Ribbed steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
  - 1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
  - 2. Door Nominal Thickness: 2 inches thick.
  - 3. Exterior Finish: Factory finished with polyester baked enamel; white color.
  - 4. Glazed Lights: Full panel width, one row; set in place with security glazing stops.
  - 5. Operation: Electric.
- B. Door Panels: Steel construction; outer steel sheet of 20 gage, 0.0359 inch minimum thickness, manufacturer's standard ribbed profile; inner steel sheet of 28 gage, 0.0149 inch minimum

thickness, ribbed profile; core reinforcement sheet steel roll formed to channel or Z shape, rabbeted weather joints at meeting rails; polyurethane insulation.

1. R-Value: 17.5, minimum.

## **2.03 DOOR COMPONENTS**

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; long-stem floating hardened steel bearing rollers, located at top and bottom of each panel, each side. Provide 2 hinges at each location.
- C. Lift Mechanism: Manufacturer's optional torsion spring, rated at 25,000 cycles, on cross head shaft, with braided galvanized steel lifting cables.
- D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- E. Head and Jamb Weatherstripping: Rectangular PVC section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- F. Head Weatherstripping: EPDM rubber seal, one piece full length.
- G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- H. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

## **2.04 ELECTRICAL OPERATION**

- A. Electrical Characteristics:
  - 1. 1/2 hp; manually operable in case of power failure, transit speed of 12 inches per second.
  - 2. 230 volts, single phase, 60 Hz.
  - 3. Refer to Section 26 27 17 for electrical connections.
- B. Motor: Manufacturer's optional NEMA MG 1, Type 4; fully enclosed - required because interior of building is unconditioned.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- D. Disconnect Switch: Factory mount disconnect switch in control panel.
- E. Electric Operator: Trolley type, screw drive, center-mounted at back of door lift run, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.
- F. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to stop door upon striking object; hollow neoprene covered to provide weatherstrip seal.
- G. Optional Photo Eye Sensor: Reverses door if objects are detected in travel path of door. Mount to tracks near bottom of door.

- H. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator.
  - 1. 24 volt circuit.
  - 2. Surface mounted.
  - 3. Locate at inside door jamb.
- I. Radio Control Antenna Detector: 1 receiver and 2 programmable transmitters.
- J. Hand-Held Transmitters: Digital control, 4-button, programmable, resettable.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

### **3.02 PREPARATION**

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

### **3.03 INSTALLATION**

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- F. Install perimeter trim.

### **3.04 TOLERANCES**

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

### **3.05 ADJUSTING**

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.



### **3.06 CLEANING**

- A. Clean doors and frames.
- B. Remove temporary labels and visible markings.

### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

**END OF SECTION**

**SECTION 08 43 13**  
**ALUMINUM-FRAMED STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass.
- B. Perimeter sealant.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 08 80 00 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.
- C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- G. Report of field testing for water leakage.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

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

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

#### **1.07 FIELD CONDITIONS**

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

#### **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Tubelite, Inc.; Product T14000 Series (Thermal-polyurethane casting): [www.tubelite.com](http://www.tubelite.com).
- B. Aluminum-Framed Storefront and Doors:
  - 1. EFCO Corporation: [www.efcocorp.com](http://www.efcocorp.com).
  - 2. Kawneer North America; 451T: [www.kawneer.com](http://www.kawneer.com).
  - 3. United States Aluminum Corp; Product IT451 (Thermal) - Center Glazed: [www.usalum.com](http://www.usalum.com).

### **2.02 STOREFRONT**

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Unitized, shop assembly.
  - 2. Glazing Rabbet: For 1 inch insulating glazing.
  - 3. Glazing Position: Front-set.
  - 4. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
  - 5. Finish: Superior performing organic coatings.
    - a. Factory finish all surfaces that will be exposed in completed assemblies.
    - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
    - c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  - 6. Finish Color: Custom, to match existing.
  - 7. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  - 8. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  - 9. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  - 10. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
  - 11. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  - 12. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
  - 13. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
- B. Performance Requirements:

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
  - a. Design Wind Loads: Comply with requirements of ASCE 7.
  - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
3. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
5. Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F), maximum.

## **2.03 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
  1. Glazing Stops: Flush.

## **2.04 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Fasteners: Stainless steel.
- D. Exposed Flashings: Aluminum sheet, \_\_\_\_ gage, 0.040 inch minimum thickness; finish to match framing members.
- E. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch minimum thickness.
- F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- G. Glazing Accessories: As specified in Section 08 80 00.

## **2.05 FINISHES**

- A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) system.
  1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil; color and gloss as indicated on drawings.

## **2.06 FABRICATION**

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

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

- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
- B. Test installed storefront for water leakage in accordance with AAMA 501.2 hose test.

### **3.05 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

### **3.06 PROTECTION**

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

**END OF SECTION**

**SECTION 08 63 00  
METAL-FRAMED SKYLIGHTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Alternate No. 1:
  - 1. Aluminum skylight framing system.
  - 2. Skylight glazing.
  - 3. Fasteners, anchors, reinforcement, and flashings.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Fabricated steel attachment devices.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Skylight counterflashing.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between skylight frames and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- J. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.
- K. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).
- L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.



- M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- N. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's specifications, standard details, and installation requirements.
- C. Shop Drawings: Indicate framed opening requirements and tolerances, spacing of members, anticipated deflection under load, affected related work, expansion and contraction joint locations and details, and sizes and locations for field welding.
  - 1. Show field measurements on shop drawings.
- D. Selection Samples: Submit full range of aluminum finish samples for Architect/Engineer's color selection.
- E. Samples: Submit two samples, not less than 12 by 12 inch in size illustrating appearance of prefinished aluminum and specified glazing system, including glazed edge and corner.
- F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- G. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.
- H. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.
- I. Manufacturer's Installation Instructions: Indicate special procedures, safety precautions, and perimeter conditions requiring special attention.
- J. Field Quality Control Submittals: Report of field testing for water leakage.

#### **1.05 QUALITY ASSURANCE**

- A. Designer Qualifications: Design skylight system under direct supervision of a professional structural engineer experienced in design of work of the type specified in this section and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not fewer than three years of documented experience.
- C. Full-Size Mock-up Testing: Have a specimen representative of project conditions tested by an independent testing agency for compliance with specified structural and water penetration criteria.
- D. Installer Qualifications: Company specializing in performing the type of work specified in this section with at least three years of documented experience and approved by manufacturer.

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

- A. Provide wrapping to protect prefinished aluminum surfaces. Do not use adhesive papers or spray coatings that bond when exposed to sunlight or weather.

## **1.07 FIELD CONDITIONS**

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

## **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work, including leaks, discoloration, and excessive thermal or structural movement, within a five year period after Date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Metal-Framed Skylights:
  - 1. Glazed Structures, Inc.: [www.gsiskylights.com](http://www.gsiskylights.com).
  - 2. Super Sky Products Enterprises, LLC; \_\_\_\_\_: [www.supersky.com](http://www.supersky.com).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 METAL-FRAMED SKYLIGHTS**

- A. Metal Framed Skylights: Factory-fabricated, glazed.
  - 1. Frame: Extruded aluminum structural members with integral condensation collection and guttering system.
  - 2. Glazing System: Pressure glazing bar system.
  - 3. Glazing: Polycarbonate panels.
  - 4. Aluminum Finish: High performance organic coatings.
  - 5. Fabricate to prevent harmonic vibration, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.
- B. Performance Requirements: Provide products that comply with the following:
  - 1. Structural Design: Design and size components to withstand dead loads and specified live loads without damage or permanent set.
  - 2. Wind Loads: Test in accordance with ASTM E330/E330M, using loads 1.5 times the specified design pressures and 10 second duration of maximum load.
  - 3. Design and size components to withstand the following load requirements without damage or permanent set:
    - a. Roof snow load: 30 lbf/sq ft.
    - b. Wind Loads: In accordance with applicable codes.
    - c. Concentrated load at any location on framing: 250 lb.
    - d. Measure performance by testing in accordance with ASTM E330/E330M, using test pressure equal to 1.5 times the design wind load and 10 second duration of maximum load.
  - 4. Glazing Support Member Deflection Under Wind Load: 1/180 of span, maximum.

5. Thermal Movement: Design system to accommodate thermal expansion and contraction over ambient temperature range of 100 degrees F, dynamic loading and release of loads, creep of concrete structural members and deflection of structural support framing without damage to skylight system components or loss of weathertightness.
6. Water Leakage: None, when measured in accordance with ASTM E331 at a test pressure difference of 2.86 lbf/sq ft.

### **2.03 MATERIALS**

- A. Aluminum Extrusions: Alloy and temper 6063-T5, 6063-T6, or 6061-T6 members complying with ASTM B221 (ASTM B221M), with minimum thickness 1/8 inch for structural members and 1/16 inch for non-structural members.
- B. Formed Aluminum: Sheet material of alloy 5052, 5005, or 6061-T651 members complying with ASTM B209 (ASTM B209M), with minimum thickness 1/8 inch for structural members and 1/16 inch for non-structural members.
- C. Internal Reinforcement: ASTM A36/A36M; Steel shapes as required for strength and mullion size limitations, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
- D. Insulating Plastic Glazing: Outer pane of polycarbonate, grey tinted transparent plastic; inner pane of polycarbonate, clear transparent plastic, each pane glazed separately.
- E. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.
- F. Touch-Up Primer for Galvanized Steel Surfaces: Zinc rich type.
- G. Protective Back Coating: Asphaltic mastic, ASTM D4479/D4479M, Type I.
- H. Flashings: 0.040 inch thick, same metal type and finish as roof flashing metal, and secured with concealed fastening method.
- I. Anchorage Devices: Type recommended by manufacturer, exposed to view.

### **2.04 FABRICATION**

- A. Rigidly fit and secure joints and corners with screw and spline. Make joints rigid, with connections that are flush, hairline, and weatherproof.
- B. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.
- C. Drain to exterior any water entering exterior joints, condensation occurring in glazing channels, or migrating moisture occurring within system.
- D. Prepare components to receive concealed anchorage devices. Ensure that fasteners and anchorage devices will be concealed upon completion of installation.

### **2.05 FINISHES**

- A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that structural curb is ready to receive skylight system. Coordinate installation of roofing and other adjacent work to ensure weathertight construction.

### **3.02 PREPARATION**

- A. Apply 1 coat of protective coating to concealed aluminum and steel surfaces in contact with dissimilar materials.

### **3.03 INSTALLATION**

- A. Install metal-framed skylights in accordance with manufacturer's instructions.
- B. Install metal-framed skylights in accordance with ASTM E2112.
- C. Set skylight structure plumb, level, and true to line, without warp or rack of frames or glazing panels. Anchor securely in place in accordance with approved shop drawings.
- D. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Install base flashings in accordance with Section 07 62 00.
- F. Install glazing in accordance with Section 08 80 00.
- G. Touch up damaged finishes so repair is imperceptible from 6 feet. Remove and replace components that cannot be satisfactorily touched up.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and inspection.
- B. Test installed skylight for water leakage in accordance with AAMA 501.2.

### **3.05 CLEANING**

- A. Upon completion of installation, thoroughly clean skylight aluminum surfaces in accordance with AAMA 609 & 610.
- B. Remove protective material from prefinished aluminum surfaces.
- C. Wash down exposed surfaces; wipe surfaces clean.
- D. Remove excess sealant by methods recommended by skylight manufacturer.

**END OF SECTION**

**SECTION 08 71 00  
DOOR HARDWARE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Hardware for wood and hollow metal doors.
- B. Thresholds.
- C. Weatherstripping, seals and door gaskets.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 14 16 - Flush Wood Doors.
- C. Section 08 36 13 - Sectional Overhead Doors: Hardware for same.

**1.03 REFERENCE STANDARDS**

- A. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.
- B. BHMA A156.2 - American National Standard for Bored and Preamsembled Locks & Latches; 2011.
- C. BHMA A156.3 - American National Standard for Exit Devices; 2014.
- D. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.
- E. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.
- F. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.
- G. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.
- H. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2013.
- I. BHMA A156.21 - American National Standard for Thresholds; 2014.
- J. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.
- K. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- L. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.
- M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project. Include catalog cuts, installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Submittal Sequence:
1. Door hardware supplier to visit site for a keying meeting with Owner prior to submitting schedules for review. Coordinate keying with shop drawings submittal.
  2. Submit hardware schedule at earliest possible date, so as not to delay fabrication of other work. Note long lead items that may be of particular concern.
- D. Final Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements. Coordinate with doors, frames and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI SEQF.
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
  3. Content: Schedules without the following will not be acceptable:
    - a. Location, type, style, function, size, fire rating, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information
    - d. Cross reference of specification set number to schedule item number.
    - e. Cross reference manufacturer's product numbers of each type of Hardware specified to the specified hardware included in schedule.
    - f. door index.
    - g. Explanation of abbreviations, symbols, and codes contained in schedule.
    - h. Mounting locations for door hardware.
    - i. Door and frame sizes and materials.
  4. Include in Hardware Schedule a description of each electrified door hardware function, including product's location sequence of operation, and interface with other building control systems.
    - a. Sequence of Operation: include description of component functions that occur in the following situations: outside operation, inside operation, LED indicators, power on/power off and any other pertinent information.
- E. Keying Schedule: Submit for approval of Owner.
- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
1. Submit manufacturer's parts lists and templates.
  2. Bitting List: List of combinations as furnished, indexed by key set number and door number.
- H. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

- I. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- K. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Lock Cylinders: One for each master keyed group.
  - 3. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

### **1.05 KEYING MEETING**

- A. Arrange meeting with door hardware supplier and Owner. Submit keying schedule for Architect's review after this meeting.
- B. Review with supplier, installers and related trades: Materials, rough-in and installation procedures, sequence of operation for each opening and coordination of related Work.

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

- A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's five year warranty for door closers and three year warranty on locksets.

## **PART 2 PRODUCTS**

### **2.01 BUTT HINGES - FURNISHED AND INSTALLED BY CONTRACTOR**

- A. Comply with BHMA A156.1 and BHMA A156.7 requirements.
- B. General: Provide hinges on every swinging door.
  - 1. Provide concealed five-knuckle, anti-friction bearing, button tip, full mortise butt hinges with square corners and non-rising loose pins unless otherwise indicated.
  - 2. Provide anti-friction bearing hinges at all doors having closers.
  - 3. Provide hinges in the quantities indicated.
  - 4. Provide non-removable pins or security studs on exterior outswinging doors.
  - 5. Provide non-removable pins security studs on outswinging doors at "secured" areas.
  - 6. Where electrified hardware is mounted in door leaf, provide power transfer hinges. Provide four- or eight-wire type as appropriate for complete installation of:
    - a. Concealed door monitoring contacts and other security access components.
    - b. Power transfer to/from other scheduled door hardware.
- C. Products:
  - 1. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).

- a. 5BB1 for Standard Application.
  - b. 5BB1HW for Exterior and High Traffic Applications.
  - c. Finish: US26D.
2. Substitutions: Not permitted.
- D. Quantity:
- 1. Doors up to 60 inches High: Two hinges per leaf.
  - 2. Doors From 60 inches High up to 90 inches High: Three hinges per leaf.
  - 3. Doors 90 inches High up to 120 inches High: Four hinges per leaf.
  - 4. Doors over 120 inches High: One additional hinge per leaf for each additional 30 inches, or fraction thereof, in height.
  - 5. Dutch Doors: Two hinges per leaf.

## **2.02 LOCK AND LATCHSETS - FURNISHED BY OWNER; INSTALLED BY CONTRACTOR**

### **2.03 BOLTS - FURNISHED AND INSTALLED BY CONTRACTOR**

- A. Flush Bolts: Lever extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame unless noted otherwise.
- 1. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
  - 2. Floor Bolts: Provide dustproof strike except at metal thresholds.
- B. Manual Flushbolts: Comply with BHMA A156.16, Grade 1 requirements. Provide lever extensions for top bolt at over-size doors.
- C. Self-Latching Flushbolts: Comply with BHMA A156.3, Grade 1 requirements. Automatically latch upon closing of door; manually retracted.
- D. Automatic Flushbolts: Comply with BHMA A156.3, Grade 1 requirements. Automatically latch upon closing of door; automatic retraction of bolts when active leaf is opened.
- E. Coordinators: Provide on doors having closers and self-latching or automatic flushbolts to ensure that leaves close in proper order.
- F. Surface Bolts: Comply with BHMA A156.16 requirements. Slide extension bolts at leading edge of door, one bolt into floor, one bolt into top of frame unless noted otherwise.
- G. Manufacturers:
- 1. Assa Abloy Brands; McKinney: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 2. Hager Companies: [www.hagerco.com](http://www.hagerco.com).
  - 3. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  - 4. Trimco Hardware: [www.trimcohardware.com](http://www.trimcohardware.com).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Finish: Same as other hardware, except use 32D and 32 (stainless steel) in lieu of 26D and 26 (plated chrome finishes), respectively, where available.



## **2.04 ELECTRIC STRIKES - FURNISHED AND INSTALLED BY OWNER**

## **2.05 CLOSERS - FURNISHED AND INSTALLED BY CONTRACTOR**

- A. Comply with BHMA A156.4, Grade 1 requirements; comply with ICC A117.1 accessibility requirements for opening force and delayed action closing.
- B. General:
  - 1. Provide surface-mounted, door-mounted closers unless otherwise indicated.
  - 2. Provide a door closer on every exterior door.
  - 3. Provide a door closer on every fire- and smoke-rated door. Spring hinges are not an acceptable self-closing device unless specifically so indicated.
  - 4. On pairs of swinging doors, if an overlapping astragal is present, provide coordinator to ensure the leaves close in proper order.
  - 5. At corridors, locate door-mounted closer on room side of door.
  - 6. At outswinging exterior doors, mount closer in inside of door.
  - 7. Provide appropriate arm assemblies, installation accessories, and special templating for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.
    - a. Where closers are scheduled for openings with acoustical doors and frames, provide closer type, arm assemblies, installation accessories and special templating compatible with cam-lift hinge operation and to maintain STC ratings of doors and frames.
  - 8. Provide inspection after installation by a factory representative to ensure proper adjustment and operation. File report with the architect after said visit has been made.
- C. Manufacturer:
  - 1. LCN, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  - 2. Substitutions: Not permitted.
- D. Model: 4000 Series (4041 preferred).
- E. Covers: Metal, with installation and adjusting information on inside of cover.
- F. Sizing: Double arm closers shall have non-sized cylinders adjustable over a range of at least 5 closing power sizes. Size closers in accordance with manufacturer's recommendations, depending upon size of door, exposure to weather, compliance with ADA requirements for operating force and anticipated frequency of use.
- G. Finish: Powder coated aluminum.

## **2.06 STOPS AND HOLDERS - FURNISHED AND INSTALLED BY CONTRACTOR**

- A. Comply with BHMA A156.8 requirements.
- B. General:
  - 1. Provide a stop for every swinging door.
  - 2. Provide wall stops, unless otherwise indicated.
  - 3. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.

4. Locate stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction. Provide floor strikes for floor holders of proper height to engage holders of doors.
  5. Where overhead stops and holders are specified, or otherwise required for proper door operation, provide heavy duty assemblies of extruded brass or bronze with no plastic parts.
  6. Stop is not required if stop function is specified for door closer.
  7. Stop is not required where magnetic holders are specified for doors.
- C. Manufacturer - Wall and Floor Stops/Holders:
1. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  2. Substitutions: Not permitted.
- D. Models:
1. Wall and Floor Stops/Holders:
    - a. Ives #WS406, FS436.
- E. Finish: Same as other hardware, except use 32D and 32 (stainless steel) in lieu of 26D and 26 (plated chrome finishes), respectively, where available.

## **2.07 GASKETING AND THRESHOLDS - FURNISHED AND INSTALLED BY CONTRACTOR**

- A. Gaskets: Comply with BHMA A156.22 requirements.
1. On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
  2. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles and mullions of pairs.
    - a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
  3. On each exterior door, provide door bottom sweep, unless otherwise indicated.
- B. Thresholds: Comply with BHMA A156.21 requirements.
1. At each exterior door, provide a threshold unless specifically detailed otherwise in the Drawings.
  2. Field cut threshold to frame for tight fit.
- C. Fasteners At Exterior Locations: Non-corroding.
- D. Manufacturers - Gasketing and Thresholds:
1. Hager Companies: [www.hagerco.com](http://www.hagerco.com).
  2. National Guard Products, Inc: [www.ngpinc.com](http://www.ngpinc.com).
  3. Pemko Manufacturing Co: [www.pemko.com](http://www.pemko.com).
  4. Reese Enterprises, Inc.: [www.reeseusa.com](http://www.reeseusa.com).
  5. Zero International, Inc: [www.zerointernational.com](http://www.zerointernational.com).

## **2.08 PROTECTION PLATES AND ARCHITECTURAL TRIM - FURNISHED AND INSTALLED BY CONTRACTOR**

- A. Comply with BHMA A156.6 requirements.
- B. Protection Plates:

1. Kickplate: Provide on push side of every door with closer, except aluminum storefront and glass entry doors.
  2. Mop Plates: Provide on door sides facing areas with hard surface floor finishes, unless kickplate or armor plate are specified.
  3. Width:
    - a. Pull side: 1 inch less than door width (LDW).
    - b. Push (Stop) Side: 2 inches less than door width (LDW).
  4. Height:
    - a. Kickplates: 10 inches.
    - b. Mop Plates: 6 inches.
    - c. Doors with louvers or narrow bottom rails: 1 inch less than dimension from the bottom of the door to the bottom of the louver or lite, or to the top of the bottom rail.
- C. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.
- D. Manufacturers:
1. Assa Abloy Brands; McKinney: [www.assaabloydss.com](http://www.assaabloydss.com).
  2. C. R. Laurence Co., Inc: [www.crl-arch.com](http://www.crl-arch.com).
  3. Hager Companies: [www.hagerco.com](http://www.hagerco.com).
  4. Hiawatha, Inc, division of Activar Construction Products Group, Inc: [www.activarcpg.com/hiawatha](http://www.activarcpg.com/hiawatha).
  5. Ives, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  6. Rockwood Manufacturing Company: [www.rockwood.com](http://www.rockwood.com).
  7. Trimco Hardware: [www.trimcohardware.com](http://www.trimcohardware.com).
  8. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Finish: Same as other hardware, except use 32D and 32 (stainless steel) in lieu of 26D and 26 (plated chrome finishes), respectively, where available.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Do not install surface mounted items until finishes applied to substrate are complete.
- D. Mounting heights for hardware from finished floor to center line of hardware item.
  1. For steel doors and frames: Comply with DHI (LOCS) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames".
  2. For Wood Doors: Comply with DHI WDHS.3 "Recommended Locations for Architectural Hardware for Flush Wood Doors".

### **3.02 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements.

B. Post Installation Inspection: Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

1. Submit report to Architect/Engineer after inspection has been made.

### **3.03 CLEANING**

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

### **3.04 PROTECTION**

A. Do not permit adjacent work to damage hardware or finish.

**END OF SECTION**

**SECTION 08 80 00  
GLAZING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
- E. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- J. GANA (GM) - GANA Glazing Manual; 2009.
- K. GANA (SM) - GANA Sealant Manual; 2008.
- L. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- M. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).
- N. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

- O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.
- P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- C. Samples: Submit two samples 12 by 12 inch in size of glass units.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

#### **1.06 FIELD CONDITIONS**

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

#### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

### **PART 2 PRODUCTS**

#### **2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Design Pressure: Calculated in accordance with ASCE 7.
  - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  4. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  3. Solar Optical Properties: Comply with NFRC 300 test method.

## 2.02 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 FT.
  3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
  4. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
  5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

## 2.03 INSULATING GLASS UNITS

- A. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  3. Warm-Edge Spacers: As required to achieve overall required glazing system U-value.
    - a. Spacer Width: 1/2 inch.
  4. Spacer Color: Black.
  5. Edge Seal:
    - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
  6. Color: Black.
  7. Purge interpane space with dry air, hermetically sealed.
- B. Type SG1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
  2. Space between lites filled with air.
  3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.

- a. Tint: Match existing.
    - b. Coating: Low-E (passive type), on #2 surface.
  - 4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
    - b. Coating: Low-E, on #3 surface.
  - 5. Total Thickness: 1 inch.
  - 6. Thermal Transmittance (U-Value), Winter - Center of Glass: As required to achieve overall system rating, as specified in Section 08 43 13.
  - 7. Visible Light Transmittance (VLT): 40 percent, minimum.
  - 8. Solar Heat Gain Coefficient (SHGC): 40 percent, maximum.
  - 9. Glazing Method: Dry glazing method, gasket glazing.
- C. Type SG2 - Insulating Glass Units: Spandrel glazing.
- 1. Applications: Exterior spandrel glazing unless otherwise indicated.
  - 2. Space between lites filled with air.
  - 3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    - a. Tint: Match existing.
    - b. Coating: Same as on vision units, on #2 surface.
  - 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
    - a. Tint: Clear.
    - b. Opacifier: Ceramic frit, on #4 surface.
    - c. Opacifier Color: As selected by Architect/Engineer from manufacturer's available colors, to achieve desired approximate match to vision glass units..
  - 5. Total Thickness: 1 inch.
  - 6. Thermal Transmittance (U-Value), Winter - Center of Glass: As required to achieve overall system rating, as specified in Section 08 43 13.
  - 7. Glazing Method: Dry glazing method, gasket glazing.

## 2.04 GLAZING UNITS

- A. Type FG1 - Monolithic Interior Vision Glazing:
- 1. Applications: Interior glazing unless otherwise indicated.
  - 2. Glass Type: Fully tempered float glass.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch, nominal.

## 2.05 GLAZING COMPOUNDS

## 2.06 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.



- C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

## **PART 3 EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

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

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

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

- A. Application - Interior Glazed: Set glazing infills from the interior of the building.
- B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- E. Place glazing tape on free perimeter of glazing in same manner described above.
- F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- G. Carefully trim protruding tape with knife.

### **3.06 FIELD QUALITY CONTROL**

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

### **3.07 CLEANING**

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

### **3.08 PROTECTION**

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

**END OF SECTION**

**SECTION 09 05 61  
COMMON WORK RESULTS FOR FLOORING PREPARATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section applies to all floors identified in the contract documents as to receive the following types of floor coverings:
  - 1. Resilient tile.
  - 2. Carpet tile.
  - 3. Thin-set ceramic tile.
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions. Include in the Base Bid all specified testing and remediation of concrete floor slabs; expect that new and existing floor slabs will fail moisture and alkalinity tests.

**1.02 RELATED REQUIREMENTS**

**1.03 PRICE AND PAYMENT PROCEDURES**

- A. Include in the Base Bid and list as a separate line item in the Contractor's Schedule of Values the cost of moisture and alkalinity testing and the cost of moisture and alkalinity remediation of concrete slabs as specified in this Section. If remediation is not required, as determined by testing agency's report, a contract modification will be issued to remove the cost of such remediation from the Contract.

**1.04 REFERENCES**

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
- E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

**1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

## 1.06 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.
  - 5. Recommendations for remediation of unsatisfactory surfaces.
  - 6. Include certification of accuracy by authorized official of testing agency.
  - 7. Submit report directly to Owner and provide copy to Architect/Engineer.
  - 8. Submit report not more than two business days after conclusion of testing.
- D. Adhesive Bond and Compatibility Test Report.
- E. Copy of RFCI (RWP).
- F. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
  - 1. Manufacturer's qualification statement.
  - 2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
  - 3. Manufacturer's installation instructions.
  - 4. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

## 1.07 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
  - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
  - 1. Provide access for and cooperate with testing agency.
  - 2. Confirm date of start of testing at least 10 days prior to actual start.
  - 3. Allow at least 4 business days on site for testing agency activities.
  - 4. Achieve and maintain specified ambient conditions.
  - 5. Notify Architect/Engineer when specified ambient conditions have been achieved and when testing will start.

- D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

## **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

## **1.09 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
  - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
  - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
  - 1. If testing agency recommends any particular products, use one of those.

## **PART 3 EXECUTION**

### **3.01 CONCRETE SLAB PREPARATION**

- A. Follow recommendations of testing agency.
- B. Perform following operations in the order indicated:
  - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:

- a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  - 2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
    - a. Do not attempt to remove coating or penetrating material.
    - b. Do not abrade surface.
  - 3. Preliminary cleaning.
  - 4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
  - 5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 7. Specified remediation, if required.
  - 8. Patching, smoothing, and leveling, as required.
  - 9. Other preparation specified.
  - 10. Adhesive bond and compatibility test.
  - 11. Protection.
- C. Remediations:
- 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
  - 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating over entire suspect floor area.
  - 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

### **3.02 REMOVAL OF EXISTING FLOOR COVERINGS**

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

### **3.03 PRELIMINARY CLEANING**

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

### **3.04 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

### **3.05 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
- C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
- D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

### **3.06 PREPARATION**

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with recommendations of testing agency.
- C. Comply with requirements and recommendations of floor covering manufacturer.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- E. Do not fill expansion joints, isolation joints, or other moving joints.

### **3.07 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

### **3.08 APPLICATION OF REMEDIAL FLOOR COATING**

- A. Comply with requirements and recommendations of coating manufacturer.

### **3.09 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

**END OF SECTION**



**SECTION 09 21 16**  
**GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire rated walls.
- B. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

**1.03 REFERENCE STANDARDS**

- A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
- H. 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.
- I. 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; 2014.
- J. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

- K. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
- M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- N. GA-216 - Application and Finishing of Gypsum Board; 2013.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - 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.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum \_\_ years of experience.

### **PART 2 PRODUCTS**

#### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

#### **2.02 METAL FRAMING MATERIALS**

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. Clarkwestern Dietrich Building Systems LLC: [www.clarkdietrich.com](http://www.clarkdietrich.com).
  - 2. Marino: [www.marinoware.com](http://www.marinoware.com).
  - 3. The Steel Network, Inc: [www.SteelNetwork.com](http://www.SteelNetwork.com).
  - 4. Tracloc North America; Product Trakloc: [www.traklocmw.com](http://www.traklocmw.com).
- B. Non-Loadbearing Framing System Components: ASTM C645; sheet steel galvanized to G60 class, 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.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

## 2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  - 1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 2. Georgia-Pacific Gypsum: [www.gpgypsum.com](http://www.gpgypsum.com).
  - 3. Lafarge North America Inc: [www.lafargenorthamerica.com](http://www.lafargenorthamerica.com).
  - 4. National Gypsum Company: [www.nationalgypsum.com](http://www.nationalgypsum.com).
  - 5. USG Corporation: [www.usg.com](http://www.usg.com).
  
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut; type X.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold resistant board is required at all locations.
  - 3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
    - c. Curved Surfaces: 2 layers of 1/4 inch.
    - d. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
  
- C. Backing Board For Tiled Surfaces:
  - 1. Application: Surfaces behind tile in areas including restrooms.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    - a. Thickness: 1/2 inch.

## 2.04 ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 inch.
  
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
  
- C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
  - 1. Types: As detailed or required for finished appearance.
  - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
  
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  - 1. Tape: 2 inch wide, paper tape or coated glass fiber tape for joints and corners, except as otherwise indicated.
  - 2. 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**

### **3.01 EXAMINATION**

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

### **3.02 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center.
  - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
  - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
  - 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

### **3.03 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### **3.04 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer 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. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

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

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

### **3.06 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: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- 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 base layer of double layer applications.
- 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.
- D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

### **3.07 TOLERANCES**

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

**END OF SECTION**

## **SECTION 09 30 00 TILING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

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

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board additional requirements.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2013.1.
- 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 for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- 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 A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
- O. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).
- P. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
- Q. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - 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, setting details, and trim components.
- D. Samples for Selection: Manufacturer's color line sample boards/books.
- E. Samples for Verification: Mount selected tile and apply grout on two plywood panels, minimum 18 x 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

## **1.06 QUALITY ASSURANCE**

- A. Maintain one copy of ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

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

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

## **1.08 FIELD CONDITIONS**

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

## **PART 2 PRODUCTS**

### **2.01 TILE**

- A. Manufacturer: All products by the same manufacturer.
  - 1. Crossville, Inc.: [www.crossville.com](http://www.crossville.com).
  - 2. Substitutions: Not permitted.
- B. Products:
  - 1. Ceramic Tile Type CT1: Glass Blox
    - a. Size: 1 x 1 inch, nominal; mounted on 12 x 12 inch sheets.
    - b. Thickness: 1/4 inch.
    - c. Shape: Square:
    - d. Color: G039 - "Amethyst"
  - 2. Ceramic Tile Type CT2: Color Blox
    - a. Size: 12 x 24 inch, nominal.
    - b. Thickness: 3/8 inch.
    - c. Shape: Square:
    - d. Color: A1101 - "Sandbox"
  - 3. Ceramic Tile Type CT2: Color Blox
    - a. Size: 12 x 24 inch, nominal.
    - b. Thickness: 3/8 inch.
    - c. Shape: Square:
    - d. Color: A1102 - "Roasted Mashmallow"

### **2.02 TRIM AND ACCESSORIES**

- A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.



B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.

1. Manufacturers: Same as for tile.

C. Non-Ceramic Trim: Satin clear anodized aluminum or satin stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.

### **2.03 SETTING MATERIALS**

### **2.04 ADHESIVE MATERIALS**

A. Manufacturers:

1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).

2. Mapei Corporation: [www.mapei.com](http://www.mapei.com).

3. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.05 MORTAR MATERIALS**

A. Manufacturers:

1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).

2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Mortar Bond Coat Materials:

### **2.06 GROUTS**

A. Manufacturers:

1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).

2. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com](http://www.laticrete.com).

B. Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.

3. Color(s): As selected by Architect/Engineer from manufacturer's full line.

C. Standard Grout: Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7.

### **2.07 ACCESSORY MATERIALS**

A. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Fluid or Trowel Applied Type:

a. Material: Synthetic rubber or acrylic.

b. Thickness: 25 mils, minimum, dry film thickness.

B. 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**

### **3.01 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.

### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, 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 ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. 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.
- N. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

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

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

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

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, thin-set with dry-set or latex Portland cement bond coat, unless otherwise indicated..
- B. Where Type CT1 accent tile is installed on same wall surface as Type CT2 and/or Type CT3 tile, build up bond coat on substrate surface and additional 1/8 inch thick in the area the CT1 tile will be installed, so that the surfaces of the CT1 tiles will be flush with the surfaces of the CT2 and CT3 tiles.

### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

### **3.07 PROTECTION**

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

**END OF SECTION**

**SECTION 09 51 00  
SUSPENDED ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 21 13 00 - Fire Suppression Sprinklers: Sprinkler heads in ceiling system.
- B. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- C. Section 26 51 00 - Lighting: Light fixtures in ceiling system.

**1.03 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; 2013a.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. 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; 2014.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

**1.04 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.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 8 inches long, of suspension system main runner, cross runner, and perimeter molding.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

## **1.06 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.

## **1.07 FIELD CONDITIONS**

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

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. USG; ASTRO Clima Plus #8223: [www.usg.com](http://www.usg.com).
  - 2. Substitutions: Not permitted.
- B. Suspension Systems:
  - 1. Rockfon, LLC; Chicago Metallic Snap-Grid 200: [www.rockfon.com](http://www.rockfon.com).
  - 2. USG: [www.usg.com](http://www.usg.com).
  - 3. Substitutions: Not permitted.

### **2.02 ACOUSTICAL UNITS**

- A. Acoustical Panels Type C1 and Type C6: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
  - 1. Size: 12 by 24 inches.
  - 2. Thickness: 5/8 inches.
  - 3. Composition: Wet felted.
  - 4. Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
  - 5. NRC Range: 0.55 to 0.60, determined in accordance with ASTM E1264.
  - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
  - 7. Edge: SLT (Shadow Line Taper).
  - 8. Surface Pattern: Fine Texture.
  - 9. Suspension System for Type C1: Exposed grid Type SS1.
  - 10. Products:

### **2.03 SUSPENSION SYSTEM(S)**

- A. 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 Type SS1: Formed steel, commercial quality cold rolled; heavy-duty.
  - 1. Profile: Tee; 15/16 inch wide face.
  - 2. Construction: Double web.

3. Finish: White painted.

## **2.04 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. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.
- D. Touch-up Paint For Cut Edges of Acoustical Units: Type and color to match acoustical units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 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. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- D. 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.
- E. 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.
- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- H. Do not eccentrically load system or induce rotation of runners.
- I. 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.

### **3.03 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.

- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.
  - 2. Double cut and field paint exposed reveal edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Install hold-down clips on panels within 20 ft of an exterior door.

### **3.04 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**

**SECTION 09 65 00  
RESILIENT FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

**1.03 REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).
- D. ASTM F1700 - Standard Specification for Solid Vinyl Tile; 2013a.
- E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).
- F. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; [www.baaqmd.gov](http://www.baaqmd.gov); 2002.
- G. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at [www.chps.net/](http://www.chps.net/).
- H. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at [www.greenguard.org](http://www.greenguard.org).
- I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.
- J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; [www.aqmd.gov](http://www.aqmd.gov).
- K. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at [www.scs-certified.com](http://www.scs-certified.com).

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - 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 plan.
- D. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 100 square feet of each type and color.
  - 3. Extra Wall Base: 100 linear feet of each type and color.

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

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

#### **1.06 FIELD CONDITIONS**

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

### **PART 2 PRODUCTS**

#### **2.01 TILE FLOORING**

- A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
  - 1. Manufacturer:
    - a. Armstrong World Industries, Inc; Imperial Texture, Standard Excelon: [www.armstrong.com](http://www.armstrong.com).
    - b. Substitutions: Not permitted.
  - 2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
  - 3. Size: 12 by 12 inch.
  - 4. VOC Content: Certified as Low Emission by one of the following :
    - a. GreenGuard Children and Schools; [www.greenguard.org](http://www.greenguard.org).
    - b. SCS Floorscore; [www.scs-certified.com](http://www.scs-certified.com).

- c. Product listing in the CHPS Low-Emitting Materials Product List at; [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm).
  - 5. Thickness: 0.125 inch.
  - 6. Color/Pattern: #51903 - "Blue/Gray".
- B. Vinyl Plank: Printed film type, with transparent or translucent wear layer.
- 1. Manufacturer:
    - a. Avion Commercial Flooring; Creek Street: [www.avionflooring.com](http://www.avionflooring.com).
    - b. Substitutions: Not permitted.
  - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
  - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
  - 4. VOC Content: Certified as Low Emission by one of the following :
    - a. GreenGuard Children and Schools; [www.greenguard.org](http://www.greenguard.org).
    - b. SCS Floorscore; [www.scs-certified.com](http://www.scs-certified.com).
    - c. Product listing in the CHPS Low-Emitting Materials Product List at; [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm).
  - 5. Plank Size: 4 by 36 inch.
  - 6. Wear Layer Thickness: 0.030 inch (0.70 mm).
  - 7. Total Thickness: 0.125 inch (3.0 mm).
  - 8. Pattern: As selected by Owner from manufacturer's full range.

## 2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
- 1. Manufacturer:
    - a. Johnsonite, a Tarkett Company; Traditional Wall Base: [www.johnsonite.com](http://www.johnsonite.com).
    - b. Substitutions: Not permitted.
  - 2. Height: 4 inch.
  - 3. Thickness: 0.125 inch thick.
  - 4. Finish: Satin.
  - 5. Length: Roll.
  - 6. Accessories: Premolded external corners and internal corners.

## 2.03 ACCESSORIES

- A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- 1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.
- B. Moldings, Transition and Edge Strips: Metal.
- C. Filler for Coved Base: Plastic.
- D. Sealer and Wax: Types recommended by flooring manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
  - 1. Test in accordance with Section 09 05 61.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

### **3.03 INSTALLATION**

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.
- E. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

### **3.04 TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

C. Install tile to quarter turn pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

### **3.05 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.

### **3.06 CLEANING**

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

### **3.07 PROTECTION**

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

**END OF SECTION**

**SECTION 09 67 00  
FLUID-APPLIED FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fluid-applied flooring.
- B. Penetrating vapor barrier.
- C. Chemical and abrasion resistant coating.

**1.02 REFERENCE STANDARDS**

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

**1.03 SUBMITTALS**

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- B. Samples: Submit two samples, 4 x 4 inch in size illustrating color and pattern for each floor material for each color specified.
- C. Manufacturer's Installation Instructions: Indicate special procedures.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

**1.04 QUALITY ASSURANCE**

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

**1.05 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.

**1.06 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.

## 1.07 WARRANTY

- A. Manufacturer's 1-year warranty covering material, installation and workmanship.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Fluid-Applied Flooring Type F5: Epoxy, two component, thermosetting, colored with mineral filler, with aggregate broadcast on base coat.
  - 1. Product: Stonshield SLT manufactured by Stonhard: [www.stonhard.com](http://www.stonhard.com).
  - 2. Other Acceptable Products:
    - a. Decor-Flor manufactured by Dex-O-Tex: .
    - b. CrownQuartz manufactured by Crown Polymers.
    - c. Dur-A-Quartz manufactured by Dur-A-Flex.
    - d. Sikafloor Quartzite manufactured by Sika Industrial Flooring.
    - e. Granit-Rock manufactured by U.S. Floor Corporation.
  - 3. Substitutions: Not permitted.
  - 4. Base Coat: 1/8 inch thick; color as selected.
  - 5. Aggregate: Small quartz chips, multiple colors as selected.
  - 6. Top Coats: Urethane, two component, thermosetting; clear; Stonseal CF7 by Stonhard or equivalent product from other Acceptable Manufacturers.
  - 7. Mildew Resistance: No growth.
  - 8. Color: Selected by Architect from manufacturer's full line.

### 2.02 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Vapor Control Barrier: Penetrating polymer barrier to control vapor transmission on concrete floors of type and application recommended by fluid-applied flooring manufacturer.

## PART 3 EXECUTION

### 3.01 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.
- F. Verify that in-floor drains are installed at the correct elevation.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION - FLOORING**

- A. Apply in accordance with manufacturer's instructions.
- B. Provide epoxy control joints over any concrete floor slab joint locations.
- C. Apply each coat to minimum thickness required by manufacturer.
- D. Finish to smooth level surface.

### **3.04 PROTECTION**

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

**END OF SECTION**

**SECTION 09 68 13  
TILE CARPETING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.
- B. Removal of existing carpet tile.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

**1.03 REFERENCE STANDARDS**

- A. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - 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. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Submit two, 9 inch long samples of edge strip.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.



## **1.06 FIELD CONDITIONS**

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

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURER**

- A. Tile Carpeting:
  - 1. Interface, Inc: [www.interfaceinc.com](http://www.interfaceinc.com).
  - 2. Substitutions: Not permitted.

### **2.02 MATERIALS - FURNISHED BY OWNER AND INSTALLED BY CONTRACTOR**

- A. Tile Carpeting, Type F2: Tufted, manufactured in one color dye lot.
  - 1. Product: "Square Footage".
  - 2. Tile Size: 18 by 18 inch, nominal.
  - 3. Thickness: 1/4 inch.
  - 4. Color: As scheduled below.
  - 5. Pattern: As scheduled below.
- B. Note: Contractor is responsible for transporting stored materials from Owner's stock within the campus to the Project Site for installation by the Contractor.

### **2.03 ACCESSORIES - PROVIDED BY CONTRACTOR**

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum; color as selected by Owner.
- C. Edge Strips: Embossed aluminum, \_\_\_\_\_ color.
- D. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

## **PART 3 EXECUTION**

### **3.01 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 wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- D. 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 Section 09 05 61.
  - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

A. Remove existing carpet tile.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

### **3.03 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 ashlar 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.

### **3.04 CLEANING**

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

### **3.05 SCHEDULE**

A. Library 80, Study Room 83 and Study Room 84: Interface Cubic, #6393 - "Height".

B. Other Areas Scheduled to Receive Carpet Tile: Interface Syncopation #6380 - "Lava".

**END OF SECTION**

**SECTION 09 91 13  
EXTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Exposed surfaces of steel lintels and ledge angles.
  - 2. Mechanical and Electrical:
    - a. On the roof and outdoors, paint piping that is exposed to weather.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Non-metallic roofing and flashing.
  - 6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
  - 7. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
  - 8. Glass.
  - 9. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.

**1.03 DEFINITIONS**

- A. Conform to ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, [www.paintinfo.com](http://www.paintinfo.com).
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, [www.paintinfo.com](http://www.paintinfo.com).
- D. SSPC-SP 1 - Solvent Cleaning; 2015.
- E. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

## 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  - 4. Manufacturer's installation instructions.
  - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect/Engineer before preparing samples, to eliminate sheens definitely not required.
  - 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry and factory finished metals, have been approved.
- D. Samples: Submit two paper chip samples, 2 x 2 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- F. Manufacturer's Instructions: Indicate special surface preparation procedures.
- G. 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.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - 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.

## 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

## **1.07 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.

## **1.08 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 exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect/Engineer is obtained using the specified procedures for substitutions.
  - 2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
  - 3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
  - 1. Benjamin Moore & Co: [www.benjaminmoore.com](http://www.benjaminmoore.com).
  - 2. PPG Paints: [www.ppgpaints.com](http://www.ppgpaints.com).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).

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

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.

2. 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.
  3. 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.
  4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  5. Supply each paint material in quantity required to complete entire project's work from a single production run.
  6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect/Engineer from the manufacturer's full line.
- C. Colors: As indicated in Color Schedule.
1. Selection to be made by Architect/Engineer after award of contract.
  2. Extend colors to surface edges; colors may change at any edge as directed by Architect/Engineer.

## **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal.
1. Two top coats and one coat primer.
  2. Top Coat(s): Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.
  3. Top Coat Sheen:
    - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
  4. Primer: As recommended by top coat manufacturer for specific substrate.

## **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.

### 3.02 PREPARATION

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

### 3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Sand metal surfaces lightly between coats to achieve required finish.
- F. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

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

### **3.05 PROTECTION**

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

### **3.06 COLOR SCHEDULE**

**END OF SECTION**



**SECTION 09 91 23  
INTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints, stains, and varnishes.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Mechanical and Electrical:
    - a. areas scheduled to receive painted finishes, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Glass.
  - 9. Acoustical materials, unless specifically indicated.
  - 10. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 13 - Exterior Painting.

**1.03 DEFINITIONS**

- A. Conform to ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.
- C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

- D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, [www.paintinfo.com](http://www.paintinfo.com).
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, [www.paintinfo.com](http://www.paintinfo.com).
- F. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition.
- G. SSPC-SP 1 - Solvent Cleaning; 2015.
- H. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- I. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect/Engineer before preparing samples, to eliminate sheens definitely not required.
  - 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, factory finished metals, wood cabinets, and wood doors, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. 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.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 2. Label each container with color in addition to the manufacturer's label.

## **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

## **1.07 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.

## **1.08 FIELD CONDITIONS**

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

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect/Engineer is obtained using the specified procedures for substitutions.
  - 2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
  - 3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
  - 1. Benjamin Moore & Co: [www.benjaminmoore.com](http://www.benjaminmoore.com).
  - 2. PPG Paints: [www.ppgpaints.com](http://www.ppgpaints.com).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).

- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

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

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. 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.
  - 3. 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.
  - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. 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.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).
    - d. Architectural coatings VOC limits of the State in which the Project is located.
  - 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.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect/Engineer from the manufacturer's full line.
- E. Colors: As indicated on drawings.
  - 1. Selection to be made by Architect/Engineer after award of contract.
  - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect/Engineer.
  - 3. \_\_\_\_\_, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

## **2.03 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
  - 3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    - b. Satin: MPI gloss level 4; use this sheen for vertical gypsum board surfaces.
    - c. Semi-Gloss: MPI gloss level 5; use this sheen for concrete masonry.
  - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
  - 1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
  - 2. Two top coats and one coat primer.
  - 3. Top Coat(s): High Performance Architectural Interior Latex; MPI #139, 140, or 141.
  - 4. Top Coat Sheen:
    - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
  - 5. Primer: As recommended by top coat manufacturer for specific substrate.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. 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. Masonry, Concrete, and Concrete Masonry Units : 12 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.

- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Masonry:
  - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  - 2. Prepare surface as recommended by top coat manufacturer.
  - 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi at 6 to 12 inches. Allow to dry.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- K. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  - 2. Prepare surface according to SSPC-SP 2.
- L. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- M. 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.
- N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

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

### **3.05 PROTECTION**

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

**END OF SECTION**

**SECTION 10 11 01  
VISUAL DISPLAY BOARDS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

A. Markerboards and Tackboards.

**1.02 RELATED REQUIREMENTS**

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

**1.03 REFERENCE STANDARDS**

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. ASTM F793 - Standard Classification of Wall Covering by Use Characteristics; 2010a.

**1.04 SUBMITTALS**

A. Product Data: Provide manufacturer's data on markerboard, tackboard, trim, and accessories.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

C. Samples: Submit two samples 2 by 2 inch in size illustrating materials and finish, color and texture of tackboard and tackboard surfacing.

D. Manufacturer's printed installation instructions.

E. Maintenance Data: Include data on regular cleaning, stain removal .

**1.05 QUALITY ASSURANCE**

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

**1.06 WARRANTY**

A. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A. Visual Display Boards:

1. MooreCo, Inc: [www.moorecoinc.com](http://www.moorecoinc.com).

2. Claridge Products and Equipment, Inc: [www.claridgeproducts.com](http://www.claridgeproducts.com).

3. Platinum Visual Systems: [www.pvusa.com](http://www.pvusa.com)



## 2.02 VISUAL DISPLAY BOARDS

- A. Markerboards: Porcelain enamel on steel, laminated to core.
  - 1. Color: White.
  - 2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
  - 3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
  - 4. Backing: Aluminum foil, laminated to core.
  - 5. Size: As indicated on drawings.
  - 6. Frame: Extruded aluminum, with concealed fasteners.
  - 7. Frame Profile: 1½ inch wide x ¾ inch deep.
  - 8. Frame Finish: Anodized, natural.
  - 9. Accessories: Provide chalk tray and map rail.
- B. Tackboards: Fine-grained, homogeneous natural cork.
  - 1. Cork Thickness: 1/4 inch.
  - 2. Fabric: Vinyl coated fabric.
  - 3. Color: As selected from manufacturer's full range.
  - 4. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
  - 5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
  - 6. Size: As indicated on drawings.
  - 7. Frame: Same type and finish as for chalkboard.

## 2.03 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Vinyl Coated Fabric: ASTM F793 Category VI.
- C. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.
- D. Foil Backing: Aluminum foil sheet, 0.005 inch thick.
- E. Aluminum Sheet Backing: 27 gage, 0.014 inch thick.
- F. Adhesives: Type used by manufacturer.

## 2.04 ACCESSORIES

- A. Tack Strip: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall, full width of frame. Provide a quantity of accessory clips equal to (1) clip for each lineal foot of track strip provided.
- B. Marker Tray: Aluminum, manufacturer's standard profile one piece full length of markerboard, molded, closed plastic insert ends; concealed fasteners, same finish as frame.
- C. Mounting Brackets: Concealed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

### **3.02 INSTALLATION**

- A. Install boards in accordance with manufacturer's instructions.
- B. Install with bottom of perimeter frame at 36 inches above finished floor.
- C. Secure units level and plumb.
- D. Butt Joints: Install with tight hairline joints.

### **3.03 CLEANING**

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Remove temporary protective cover at Date of Substantial Completion.

**END OF SECTION**

**SECTION 10 22 39  
FOLDING PANEL PARTITIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Folding panel partitions.
- B. Ceiling track and operating hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 12 00: Overhead track structural support framing.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking and track support shimming.
- C. Section 07 90 05: Acoustical sealant.
- D. Section 09 21 16: Acoustic barrier placed between top of partition track and roof deck above.
- E. Section 09 51 00: Adjacent ceiling finish.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- C. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- D. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions; 2012.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on partition materials, operation, hardware and accessories, track switching components, and colors and finishes available.
- C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.
- D. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.
- E. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, and texture.
- F. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.
- G. Manufacturer's Instructions: Indicate special procedures.

H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

## **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this section with minimum five years of documented experience.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Basis of Design: Hufcor, Inc. Acousti-Seal Encore - Paired Panels: [www.modernfold.com](http://www.modernfold.com)..
- B. Other Acceptable Manufacturers:
  - 1. Hufcor, Inc: [www.hufcor.com](http://www.hufcor.com).
  - 2. Kwik-Wall Company: [www.kwik-wall.com](http://www.kwik-wall.com).
  - 3. Panelfold, Inc: [www.panelfold.com](http://www.panelfold.com).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 COMPONENTS**

- A. Operable Panel Partition: Center opening; paired panels; center stacking; manually operated.
  - 1. Panel Finish: Vinyl coated fabric .
  - 2. Sound Transmission Class (STC): 54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.
  - 3. Surface Burning Characteristics of Panel Finish: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
  - 4. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.
  - 5. Hanging Weight: 9.5 lbs./s.f.
- B. Panel Construction: Unitized.
  - 1. Panel Substrate Facing: Steel sheet.
- C. Core: 16 gage, 0.0598 inch thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
  - 1. Thickness with Finish: 4.25 inches.
  - 2. Factory applied surface finish.
  - 3. Trim: Trimless.
  - 4. Hinges: Continuous full leaf type, attached directly to panel frame.
  - 5. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
- D. Track: Formed 11 ga. (0.12 inch) thick steel; profile, track hanger bracket and hanger rods all designed to support required loads. Product: Modernfold #17 Track Assembly.

- E. Carriers: Steel, ball bearing wheels on trolley carrier at top of every panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
- F. Hardware: Latching door handles of cast steel, satin chrome finish.
- G. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals.
- H. Final Closure: Horizontally expanding panel edge with removable crank.
- I. Vinyl Coated Fabric: 21 oz./yd. reinforced vinyl with woven backing; color as selected by Owner from manufacturer's standard range.
- J. Accessories: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- C. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.
- D. Verify wall plumbness of 1/8 inch in 10 feet, non-cumulative.

#### **3.02 INSTALLATION**

- A. Install partition in accordance with manufacturer's instructions and ASTM E557.
- B. Fit and align partition assembly and pocket doors level and plumb.
- C. Lubricate moving components.
- D. Install acoustic sealant to achieve required acoustic performance.

#### **3.03 ADJUSTING**

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust partition assembly to achieve lightproof seal.

#### **3.04 CLEANING**

- A. Clean finish surfaces and partition accessories.

#### **3.05 CLOSEOUT ACTIVITIES**

- A. Demonstrate operation of partition and identify potential operational problems.

**END OF SECTION**

**SECTION 10 28 00**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Accessories for toilet rooms and lab spaces.
- B. Grab bars.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

**1.03 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2011.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Toilet Accessories:
  - 1. ASI - American Specialties, Inc: [www.americanspecialties.com](http://www.americanspecialties.com).
  - 2. Bradley Corporation: [www.bradleycorp.com](http://www.bradleycorp.com).
  - 3. Gamco USA: [www.gamcousa.com](http://www.gamcousa.com).
  - 4. Bobrick Washroom Equipment, Inc.: [www.bobrick.com](http://www.bobrick.com).
  - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. All items to be made by the same manufacturer.

## 2.02 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.
  - 1. Grind welded joints smooth.
  - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

## 2.03 FINISHES

- A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.
- D. See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
  - 1. Grab Bars: As indicated on the drawings.
  - 2. Mirrors: 40 inch, measured to bottom of mirrored surface.
  - 3. Other Accessories: As indicated on the drawings.
- D. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.

### **3.04 SCHEDULE**

- A. Refer to Enlarged Plan Drawing A500 for schedule of toilet accessories.

**END OF SECTION**



**SECTION 10 44 00  
FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire blankets.
- C. Accessories.

**1.02 REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.
- C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.04 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguishers and Accessories:
  - 1. JL Industries, Inc: [www.jlindustries.com](http://www.jlindustries.com).
  - 2. Kidde, a unit of United Technologies Corp: [www.kidde.com](http://www.kidde.com).
  - 3. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 4. Nystrom, Inc: [www.nystrom.com](http://www.nystrom.com).
  - 5. Potter-Roemer: [www.potterroemer.com](http://www.potterroemer.com).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.

**2.02 FIRE EXTINGUISHERS**

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.

1. Class: A:B:C type.
2. Size: 10 pound.
3. Finish: Baked polyester powder coat, red color.

### **2.03 ACCESSORIES**

- A. Fire Blanket: Fire retardant treated wool; red, 62 x 84 inch size with arm loops.
  1. Cabinet: Surface mounted, roller-type. Factory painted enamel red.
- B. Extinguisher Brackets: Formed steel, chrome-plated.
- C. Inspection/Certification Tags: Acceptable to the authority having jurisdiction.
  1. Expiration Date: Not less than 12 months after date of Substantial Completion.
  2. Provide (1) for each fire extinguisher.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 54 inches from finished floor to top of extinguisher/fire blanket cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers on wall brackets.
- E. Attach Inspection/Certification tags to extinguishers.

**END OF SECTION**

**SECTION 10 51 00  
LOCKERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal lockers.
- B. Metal tops.

**1.02 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- D. Samples: Submit three samples 3 x 6 inches in size, of each color scheduled; applied to specified base metal.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect locker finish and adjacent surfaces from damage.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Metal Lockers:
  - 1. Art Metal Products: [www.artmetalproducts.com](http://www.artmetalproducts.com).
  - 2. Lyon Workspace Products: [www.lyonworkspace.com](http://www.lyonworkspace.com).
  - 3. Penco Products, Inc: [www.pencoproducts.com](http://www.pencoproducts.com).
  - 4. Republic Storage Systems Co: [www.republicstorage.com](http://www.republicstorage.com).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.

**2.02 LOCKER APPLICATIONS**

- A. Faculty/Staff Lockers: Single tier metal lockers, wall mounted with matching closed base.
  - 1. Width: 12 inches.
  - 2. Depth: 12 inches.
  - 3. Height: 60 inches.
  - 4. Fittings: Hat shelf, 2 coat hooks.
  - 5. Locking: Built-in combination locks.
  - 6. Provide sloped top.

## 2.03 METAL LOCKERS

- A. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
  - 1. Where ends or sides are exposed, provide flush panel closures.
  - 2. Color: Single color for all lockers, to be selected by Owner from manufacturer's standard color line.
- B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
  - 1. Body and Shelves: 24 gage, 0.0239 inch.
  - 2. Base: 20 gage, 0.036 inch.
  - 3. Metal Base Height: 4 inch.
- C. Frames: Formed channel shape, welded and ground flush, welded to body.
  - 1. Door Frame: 16 gage, 0.0598 inch, minimum.
- D. Doors: Hollow channel edge construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
  - 1. Door Outer Face: 16 gage, 0.0598 inch, minimum.
  - 2. Form recess for operating handle and locking device.
  - 3. Provide louvers in door face, top and bottom, for ventilation.
- E. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.
  - 1. Hinge Thickness: 14 gage, 0.0747 inch.
- F. Sloped Top: 20 gage, 0.0359 inch, with closed ends.
- G. Coat Hooks: Stainless steel or zinc-plated steel.
- H. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 1/2 inch high of block font style, in contrasting color.
- I. Locking device supplied by Owner.

## 2.04 FINISHING

- A. Clean, degrease, and neutralize metal; prime and finish with one coat of baked enamel.
- B. Paint locker units 1 color, as selected.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Place and secure on prepared base.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.

- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels and sloped tops.
- G. Install accessories.
- H. Replace components that do not operate smoothly.

### **3.02 CLEANING**

- A. Clean locker interiors and exterior surfaces.

**END OF SECTION**

## **SECTION 10 82 13 ROOF SCREENS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Stand-alone roof equipment screens and supporting steel framework. Screens shall be designed to attach to the roof structure and not the equipment being screened.
- B. Roof screen accessories.

#### **1.02 RELATED SECTIONS**

- A. Section 05 12 00 - Structural Steel: Metal Framing.
- B. Section 05 50 00 - Metal Fabrications: Frames and supports.
- C. Section 06 10 00 - Rough Carpentry: Wood Framing.

#### **1.03 REFERENCES**

- A. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM A 1008 - 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.
- E. ASTM B 749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- F. ASTM D 4811 - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing.
- G. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
- H. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- J. AWS D1.1 - Structural Welding Code - Steel.
- K. AWS D1.6 - Structural Welding Code - Stainless Steel.

#### **1.04 COORDINATION**

- A. Coordinate Work with other operations and installation of roofing materials to avoid damage to installed insulation and membrane materials.

### **1.05 ACTION SUBMITTALS**

- A. Submit under provisions of Section 01 30 00.
- 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. Installation methods.
- C. Shop Drawings: Layout and erection drawings showing typical cross sections and dimensioned locations of all frames and base supports. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

### **1.06 INFORMATIONAL SUBMITTALS**

- A. Design Calculations: Structural design calculations for structural components and components resisting wind loads with seal and signature of structural engineer licensed in the State of Illinois.
- B. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
- D. Warranties: 3 signed copies.

### **1.07 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Manufacturer with a minimum five years documented experience in producing pre-manufactured metal-framed equipment screens.
- B. Design Qualifications: Provide structural design calculations stamped by a professional engineer licensed in the state in which this project is located.
- C. Welders: AWS certified within previous 12 months.
- D. Pre-Installation Meeting:
  - 1. Convene at job site, at least seven calendar days prior to scheduled beginning of construction activities of this section, to review requirements of this section.
  - 2. Require attendance by representatives of the installing subcontractor (who will represent the system manufacturer), the mechanical subcontractors and other entities affected by construction activities of this section.
  - 3. Notify Architect four calendar days in advance of scheduled meeting date.

### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, handle and store materials in conformance with the manufacturers printed instructions.

- B. Store products under cover, in manufacturer's unopened packaging until ready for installation.
- C. Protect materials from exposure to moisture.
- D. Store materials in a dry, warm, ventilated weathertight location.
- E. Protect metal fabrications from damage by exposure to weather.
- F. Handling: Use a forklift or crane to move material. Do not lift the bundles by the metal bands.
  1. Fork Lift: Spread the forks as far as possible to balance the load. Drive slowly when moving long bundles over uneven surfaces to avoid tipping the load
  2. Crane: Position the canvas sling straps so that the space between the straps is at least 1/3 the length of the bundle. Use sling straps with looped ends running one end of the strap through the loop at the other end to cinch the bundle when lifted. When setting the load on the roof, put wood blocks under it to protect the roof and allow space to remove the sling straps.
  3. Roof Placement: Spread the bundles and crates out as much as possible to avoid overloading the roof structure. Place the material directly over major supports such as beams or trusses.
  4. Position bundles of tubing parallel to the slope of the roof and block prior to opening to prevent the tubing from rolling down the roof slope when unbundled.

## 1.09 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Field Measurements: Verify roof screen dimensions and conditions of the installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating equipment enclosure without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

## 1.10 WARRANTY

- A. Framing System: Provide manufacturer's standard written limited warranty stating that the complete framing system shall be warranted against structural failure due to cracking, buckling, bending, tearing or corrosion arising under normal use and environmental conditions for the coverage period applicable.
  1. Products installed on projects located 2 miles or greater from salt or brackish bodies of water shall be warranted for twenty (20) years
  2. Products installed on projects located greater than 1 mile but less than 2 miles from salt or brackish bodies of water will be warranted for five (5) years, except for aluminum, stainless steel or copper Products which will be warranted for twenty (20) years.
  3. Products installed on projects located 1 mile or less from salt or brackish bodies of water will be warranted for three (3) years, except for aluminum, stainless steel or copper Products which will be warranted for twenty (20) years
- B. Panel Finish:



1. Provide written warranty stating that the paint finish applied on all equipment enclosure panels will warranted against chipping, peeling, cracking, fading, or blistering in accordance with the General Conditions for the coverage period of twenty (20) years.
  2. Provide warranty signed by the panel manufacturer and paint finish applicator (if separate from manufacturer).
- C. The above warranties are in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

## **PART 2 PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

- A. Design Loads: Comply with Building Code for site location and building height.
1. Design to resist ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
  2. Design all materials, assembly and attachments to resist snow, wind, suction and uplift loading at any point without damage or permanent set.
- B. Structural Design: Prepare structural design calculations for screen framing and attachment to structure including reactions at base supports for verification of roof structure by Architect.
- C. All welds to be performed by an AWS certified welder. Valid certification to be provided.

### **2.02 MANUFACTURERS**

- A. Acceptable Manufacturer: RoofScreen Mfg., which is located at: 347 Coral St. ; Santa Cruz, CA 95060; Toll Free Tel: 866-766-3727; Tel: 831-421-9230; Fax: 866-253-0738; Email: request info (info@roofscreen.com); Web: www.roofscreen.com.
- B. Substitutions: Not permitted.

### **2.03 MATERIALS**

- A. Square Base Supports: Weldments fabricated from cold rolled steel conforming to ASTM A 1008, fabricated with pre-punched holes in base plate for fastening to roof structure. After fabrication, apply minimum 2 to 4 mil baked on powder coat primer.
1. Height 12 inches (305 mm).
- B. Square Base Cap: Weldments fabricated from cold rolled steel conforming to ASTM A 1008 and fabricated to overlap base support and flashing boot a minimum of 2 inches (51 mm). Provide moment resisting sprocket connection to attached framing to base cap. After fabrication finish as follows:
1. Powder coat, minimum 2-4 mils baked on.
  2. Color: Cardinal Industrial Finishes, P004-BK02.
- C. Roof Flashing: Refer to Division 07 section that specifies the roof membrane.
- D. Base Cap Gasket: EPDM with self-adhesive closed cell foam.
- E. Framing: Carbon steel structural tubing in manufacturer's standard sizes, conforming to ASTM A 500 with manufacturer's standard galvanized coating conforming to ASTM B 117 salt spray testing. Provide with wall thickness as determined by structural calculations.

- F. Connector Fittings: Fabricated from cold rolled steel conforming to ASTM A 1008. After fabrication, apply zinc plating conforming to ASTM B 633 Type 1, then baked on powder coating minimum 2 to 4 mil Cardinal Industrial Finishes, P004-BK02.
- G. Steel Z section: Steel sheet conforming to ASTM A 653, Class SS, with a G90 hot-dip galvanized coating.
- H. Steel Hat Channel: Steel sheet conforming to ASTM A 653, Class SS, with a G90 hot-dip galvanized coating.
- I. Hardware: Bolts, nuts, washers and screws 18-8 stainless steel.
- J. Welding Materials: AWS D1.1; type required for materials being welded.
- K. Panel:
  - 1. Profile:
    - a. 3 inch Deep Rib Panel.
  - 2. Base Metal:
    - a. Minimum 26 gauge Galvalume steel sheet, AZ50, conforming to ASTM A 792 for painted and unpainted panels.
  - 3. Finish:
    - a. PVDF fluoropolymer, 1 mil, 2 coat, 70 percent.
    - b. Color as selected by Architect from manufacturer's standard color range, 20 colors minimum.
  - 4. Panel Fasteners: No. 14 self-tapping sheet metal screw. Color coat heads to match panel color.
  - 5. Panel Trim: Same material and finish as panel. Configuration as shown on Drawings

## **2.04 FABRICATION**

- A. Fabricate ends of tubing with flat crimp for connections.
- B. Fit and shop assemble items in largest practical sections, for delivery to site.
- C. Fabricate items with joints tightly fitted and secured.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Fabricate system components so that portions of screen can be dismantled for repairs to equipment being screened and for future roof replacement.
- G. Trim and Closures: Fabricated from 24 gauge metal and finished with the manufacturer's standard coating system.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine area where work will be installed to verify the installation can be performed in accordance with the Drawings and structural calculation requirements without interference from other equipment or trades.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Do not begin installation until conditions have been properly prepared.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.
- D. Anchor fabrications to structure as indicated.
- E. Separate dissimilar metals and use gasketed fasteners, isolation shim, or isolation tape to eliminate possibility of corrosive or electrolytic action between metals.
- F. Exercise care when installing components so as not to damage finish surfaces. Touch up as required to repair damaged finishes.
- G. Install flashing boots at base supports as required to provide a watertight connection. Install as recommended by the roof membrane manufacturer.
- H. Remove all protective masking from material immediately after installation.

### **3.04 CLEANING AND PROTECTION**

- A. Remove all protective masking from framing and trim material immediately after installation. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. Maintain in a clean condition during construction.
- B. Protect installed products until completion of project.
  - 1. Ensure that finishes and structure of installed systems are not damaged by subsequent construction activities.

2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.
- C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.
- D. Replace metal wall panels and framing members that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION**

**SECTION 11 53 00  
LABORATORY EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Laboratory equipment:
  - 1. Fume hoods.
  - 2. Scullery sink.
  - 3. Apparatus rods.
  - 4. Glassware drying racks.
  - 5. Glassware washers.
- B. Connection to utilities.
- C. Service fittings and outlets.

**1.02 RELATED REQUIREMENTS**

- A. Section 12 35 53.19 - Wood Laboratory Casework: Base Cabinets supporting fume hoods.
- B. Section 12 36 00 - Countertops: Epoxy resin countertops.
- C. Section 23 31 00 - HVAC Ducts and Casings: Duct connections to fume hoods.
- D. Section 23 09 26 - Laboratory Airflow Control System: Airflow safety monitoring system.
- E. Section 26 27 17 - Equipment Wiring: Final electrical connections to laboratory equipment.

**1.03 REFERENCE STANDARDS**

- A. SEFA 7 - Laboratory and Hospital Fixtures; 2010.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.
- B. Preinstallation Meeting: Convene one week before starting work of this section.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide equipment dimensions and construction, equipment capacities, physical dimensions, utility and service requirements and locations, point loads and specified equipment options.
- C. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required, piping diagrams, wiring diagrams and coordination of work by others.
- D. Samples: Submit two samples of exposed finish surfaces, 2 x 4 inch in size illustrating color and finish.

- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Indicate special installation requirements and coordination of work by others.
- G. Operation Data: Include description of equipment operation and required adjusting and testing .
- H. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Project Record Documents: Record actual locations of concealed utility connections and as-installed deviations from Construction Documents.

## **1.06 QUALITY ASSURANCE**

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

## **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 FUME HOODS**

- A. Manufacturers:
  1. BMC, Inc.; Airfoil Bypass Series: [www.bmclab.com](http://www.bmclab.com).
  2. Kewaunee Scientific Corp.; Supreme Air Series: [www.kewauness.com](http://www.kewauness.com).
  3. Hamilton Laboratory Solutions, LLC.; SafeAire II Series: [www.hamiltonlab.com](http://www.hamiltonlab.com).
  4. Mott Manufacturing; Pro Series: [www.mott.ca](http://www.mott.ca).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Bench-Type Chemical Fume Hoods: Units consisting of a Restricted Bypass superstructure, set on laboratory casework manufactured specifically for fume hood support.
  1. Nominal Width: As scheduled.
  2. Nominal Depth: As scheduled.
  3. Construction: Double-wall construction; 18 ga. steel outer shell and corrosion-resistant fiberglass reinforced polyester inner liner.
    - a. Outer Shell Finish: Color as selected by Owner from manufacturer's full line of color options. Single color for all exterior shell/sill/sash components.
    - b. Inner Liner Finish: White color.
    - c. UL Listed components.
  4. Baffles: Fixed.
  5. Sash: Vertical, standard unframed, full-view type with 7/32 inch laminated safety glass and full width recessed 18 ga. stainless steel pull.

- a. Stops: Provide at 18 inch operating height (with manual override) and at 28½ inch set-up height.
  - b. Counterweight: Suspended on 3/32 inch stainless steel stranded cable with ball bearing nylon pulleys.
  - 6. Bypass: Located above sash; engineered for positive draw; controlled by sash operation.
    - a. Maintain constant exhaust volume regardless of sash position.
    - b. As sash is lowered, maximum face velocity is limited to 4 times face velocity with sash full open.
  - 7. Exhaust Collar: Round.
  - 8. Worksurface: Epoxy resin; 1 inch thick; black color.
  - 9. Cup Sink: Epoxy resin.
  - 10. Secondary Trough: At front edge of worksurface, for containment of spills.
  - 11. Plumbing: Factory pre-piped to point of connection shown in manufacturer's details.
    - a. Natural Gas Piping: 0.375 inch Schedule 40 black iron pipe.
    - b. Other Service Piping: 0.375 inch OD copper.
    - c. Waste Piping: Acid-resistant.
  - 12. Electrical: Factory pre-wired to point of connection shown in manufacturer's details and diagrams.
    - a. Convenience Power: Polarized 3-wire, grounding type 120V, 20A NEMA 5-20R power receptacles..
    - b. Lighting: Two-tube T8 fluorescent fixture; toggle switch on perimeter frame.
  - 13. Safety Monitoring System: See Section 23 09 26.
- C. Accessories:
- 1. Top Enclosure: Provide supplementary enclosure of same material and construction as hood exterior to fully enclose space between top of hood superstructure and finished ceiling construction. Extend enclosure a minimum of 2 inches above finished ceiling elevation, to allow ceiling to be butted and attached to sides of enclosure. Finish to match fume hood superstructure. If required by manufacturer's fume hood design, provide a louvered opening in enclosure to allow air to flow to bypass in top of fume hood.
  - 2. Exhaust Duct Static Pressure Gauge: Flush-mounted, diaphragm-actuated, with pointer zero adjustment, two static pressure tips and fittings for 1/4 inch metal tubing.
  - 3. Audible Alarm Silencer: Push-button; silences alarm for 5 minutes.
  - 4. Test Circuit: For ventilation of proper operation of safety monitoring system.
- D. Fume Hood Service Fittings and Fixtures:
- 1. Manufacturer: Same as fume hood manufacturer.
  - 2. Provide units that comply with SEFA 7, complete with washers locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods and similar items.
  - 3. Water Outlet:
    - a. Single Faucet: Panel-mounted, for remote control; 6 inch rigid gooseneck; vacuum breaker; serrated hose end and index color (green) powder-coat finish.
      - 1) Remote Control Valve: Handle with green "CW" index disk; black nylon guide plate for mounting on fume hood perimeter frame.
  - 4. Fume Hood Natural Gas Outlet:

- a. 45 Degree Angle Outlet Fitting: Panel-mounted, for remote control; serrated hose end and index color (blue) powder-coat finish.
  - 1) Remote Control Valve: Needle valve and handle with blue "GAS" index disk; black nylon guide plate for mounting on fume hood perimeter frame.
- 5. Escutcheons: Brass, with finish to match fitting.

## 2.02 WASHING EQUIPMENT

- A. Scullery Sink: Two-compartment; 304 satin stainless steel; 96 x 27 inches overall, with 14 inch deep compartments; integral right and left drain boards with marine edges; 4 inch radius coved corner construction; full length 8 inch high backsplash with 45 degree sloped top; (4) 1-5/8 inch OD 16 gaugestainless steel support legs NSF certified.
  - 1. Product: Weldbilt Model #WNSF8248LR manufactured by Elkay: [www.elkayusa.com](http://www.elkayusa.com).
  - 2. Faucet Holes: 5; locate where indicated - see Interior Elevation 2 on Drawing A901.
  - 3. Drain Fittings: Qty. 2; 304 stainless steel; for 3½ inch opening with grid strainer and tailpiece; polished finish. Product: #LK18B manufactured by Elkay: [www.elkayusa.com](http://www.elkayusa.com).
- B. Scullery Sink Water Outlets: Forged brass body; self-contained compression valve unit with replaceable stainless steel seat; forged brass cross handles; polished chrome plated finish.
  - 1. Manufacturer: WaterSaver Faucet Co.: [www/wfslab.com](http://www/wfslab.com).
  - 2. Mixing Faucet: Panel-mounted; 12 inch swing gooseneck; vacuum breaker; removable aerator; integral blade handles with red "HW" and green "CW" index color disks. Product: WaterSaver #L1712VB-WSA-12.
  - 3. Pre-Rinse Sprayer: Panel-mounted; self-closing squeeze valve with rubber-bound spray head; in-line vacuum breaker; integral blade handles with red "HW" and green "CW" index color disks. Product: WaterSaver #PR1711WSA-BH-110.
  - 4. Deionized Water Faucet: Panel-mounted; inert polypropylene lining; 12 inch swing gooseneck, vacuum breaker; removable serrated hose end; self-closing lever handle on left side with white "DI" index disk. Product: WaterSaver #L7854-VB-LH-12.
  - 5. Escutcheons: Brass or stainless steel with finish to match faucet.
- C. Glassware Drying Racks: 20 ga. 304 stainless steel with #4 finish; 30"W x 30"H; removable white, chemical-resistant polypropylene, (50) 6 inch long x 1/2 inch dia. pegs; 4 inch deep drip trough with drain outlet for hose clamp connection; 36 inch lexible clear plastic drainage tube to direct liquids into sink basin.
- D. Glassware Washer: Undercounter type; standard height for 36" high counter; high heat up to 199 degrees F; no viewing window.
  - 1. Electrical Characteristics: 230VAC, 60 Hz, 12A.
  - 2. Product: Labconco; FlaskScrubber Model #4420321: [www.labconco.com](http://www.labconco.com).

## 2.03 MISCELLANEOUS EQUIPMENT

- A. Apparatus Rack Assemblies:
  - 1. Vertical Rods: 1/2 inch diameter stainless steel; 36 inches long; tapered end for drop-in type socket; qty. (2) required per assembly.
  - 2. Horizontal Rods: 1/2 inch diameter stainless steel; 48 inches long; qty. (1) required per assembly.



3. Adjustable Clamps: Stainless steel; for clamping two rods at 90 degree angle; one open side; set screws with thumbturns for anchoring rods; qty. (2) required per assembly.
4. Rod Sockets: Stainless steel; for recessed mounting; smooth, tapered sleeve for drop-in type rods; qty. (2) required per assembly.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that rough-in frames, anchors and supports are accurately placed.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with standards required by authority having jurisdiction.
- C. Anchor equipment securely in place.
- D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- E. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect/Engineer.

#### **3.03 INTERFACE WITH OTHER PRODUCTS**

- A. Coordinate installation of service fittings with fume hoods and countertops.

#### **3.04 ADJUSTING**

- A. Adjust operating equipment to efficient operation.
- B. Adjust fume hood sashes, service fixtures, accessories another moving or operating components for smooth and proper operation.

#### **3.05 CLOSEOUT ACTIVITIES**

- A. Demonstrate equipment operation and maintenance.

#### **3.06 SCHEDULES**

- A. Fume Hoods:
  1. Type A Hood:
    - a. Location: Prep Room 46.
    - b. Nominal Width: 48 inches.
    - c. Nominal Depth: 32 inches.
    - d. Service Fittings and Fixtures:
      - 1) Natural Gas: (1) 45 Degree Angle Outlet Fitting on left side, with valve handle in bottom right position on frame.
      - 2) Water: (1) on right side, over cup sink, with valve handle in bottom right position on frame.
      - 3) Cup Sink: Oval, 6 x 3 inches; locate at back, right.
    - e. Convenience Power: (4) duplex receptacles - (2) on each side of frame.

- f. Light switch: Top right.
- 2. Type B Hood:
  - a. Location: Science .
  - b. Nominal Width: 60 inches.
  - c. Nominal Depth: 32 inches.
  - d. Service Fittings and Fixtures:
    - 1) Water: (1) Single Faucet on right side, over cup sink, with valve handle in bottom right position on frame.
    - 2) Cup Sink: Oval, 6 x 3 inches; locate at back, right.
  - e. Convenience Power: (4) duplex receptacles - (2) on each side of frame.
  - f. Light switch: Top right.

**END OF SECTION**

**SECTION 12 35 53.19**  
**WOOD LABORATORY CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wood cabinets and cabinet hardware.
- B. Wood table frames.
- C. Countertops.
- D. Service fittings and outlets.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- B. Section 12 36 00 - Countertops: Additional requirements for countertops.

**1.03 DEFINITIONS**

- A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.
- B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.
- C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

**1.04 REFERENCE STANDARDS**

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.
- D. SEFA 2.3 - Installation of Scientific Laboratory Furniture and Equipment; 2010.
- E. SEFA 3 - Work Surfaces; 2010.
- F. SEFA 7 - Laboratory and Hospital Fixtures; 2010.
- G. SEFA 8W - Laboratory Grade Wood Casework; 2010.

**1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.
- B. Service Fixtures: Coordinate location and characteristics of service connections.

## **1.06 SUBMITTALS**

- A. Product Data: Component dimensions, configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware, accessories, and service fittings, if any.
- B. Shop Drawings: Casework locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required, and utility locations, if any. Indicate relationship of units to windows, doors, surrounding walls and other building components.
- C. Samples For Color Selection: Wood samples, 3 x 5 inches, fully finished, for color and species selection.
- D. Samples For Verification:
  - 1. Hardware: Pulls, slides, hinges and locks.
- E. Test Reports: From independent laboratory indicating compliance with referenced chemical-resistance standards for cabinet finish and liner materials.
- F. Documentation from the manufacturer identifying VOC and chemical component limits for all wood glues and sealants.
- G. Documentation from the manufacturer showing that all composite wood products provided do not contain urea-formaldehyde resin.
- H. Manufacturer's Installation Instructions.
- I. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- J. Manufacturer's Warranty.

## **1.07 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
- B. Single Source: Provide wood laboratory casework components from a single casework manufacturer.
- C. Installer Qualifications: Certified by the manufacturer.

## **1.08 DELIVERY, STORAGE AND HANDLING**

- A. Schedule delivery so rooms are sufficiently complete that material can be installed immediately upon delivery.
- B. Protect finished surfaces from soiling and damage during handling and installation.

## **1.09 FIELD CONDITIONS**

- A. Deliver and install wood laboratory casework only after the following conditions are met:
  - 1. Windows and doors are installed and the building is secure and weathertight.
  - 2. Ceilings, overhead ductwork and lighting are installed in spaces to receive wood laboratory casework.

3. Painting and flooring work are complete in spaces to receive wood laboratory casework.
4. Interior building temperature is maintained at 65 to 80 degrees F, and ambient relative humidity is maintained at 25% to 55% prior to delivery, and during and after installation of wood laboratory casework.

## **1.10 WARRANTY**

- A. Manufacturer's one-year warranty against defects in materials and workmanship.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Wood Laboratory Casework:
  1. Diversified Woodcrafts, Inc. [www.diversifiedwoodcrafts.com](http://www.diversifiedwoodcrafts.com).
  2. Hamilton Scientific LLC: [www.hamiltonscientific.com](http://www.hamiltonscientific.com).
  3. Institutional Casework, Inc.: [www.iciscientific.com](http://www.iciscientific.com).
  4. Lab Crafters, Inc.: [www.lab-crafters.com](http://www.lab-crafters.com).
  5. Leonard Peterson & Co., Inc.: [www.lpco.com](http://www.lpco.com).
  6. Kewaunee Scientific Corp: [www.kewaunee.com](http://www.kewaunee.com).
  7. Mott Manufacturing Ltd.: [www.mott.ca](http://www.mott.ca).
  8. Westmark Products, Inc: [www.westmarkproducts.com](http://www.westmarkproducts.com).
  9. Wood-Metal Industries: [www.wood-metal.com](http://www.wood-metal.com).

### **2.02 WOOD LABORATORY CASEWORK**

- A. Cabinets, General: Solid wood and composite wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels.
  1. Style: Flush overlay. Square edged doors and drawer fronts, with 1/8" gaps between doors and between drawer fronts, and a 1/16" offset from doors and drawer fronts to cabinet body edges.
  2. Construction: Provide joints doweled, glued and screwed, except drawers may be lock shoulder jointed; with interior of units smooth and flush; cabinet bottom flush with top of face frame; without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
  3. Joinery Method: Case body joints doweled using 8mm laterally fluted hardwood dowels spaced per AWI/AWMAC/WI (AWS) and glued and screwed (except that drawers may be lock shoulder jointed and pinned or multiple-dovetailed), with interior of units smooth and flush; cabinet bottom flush with top of face frame; without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
  4. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7, and SEFA 8W, components safely support the following minimum loads:
    - a. Base Units: 500 lbs/linear ft across the cabinet ends.
    - b. Suspended Units: 300 lbs static load.
    - c. Tables: 300 lbs, minimum, on four legs.
    - d. Drawers: 125 lbs, minimum.
    - e. Hanging Wall Cases: 300 lbs (136 kg).
    - f. Shelves: 100 lbs, minimum.

5. Unit Dimensions: Widths and depths of individual units within 1/2 inch of what is shown on Drawings. Manufacturer's "standard" unit sizes are acceptable only if meeting this requirement.
6. Glazing: With gasket and removable stops; minimize rattling and vibration.
7. Scribes and Fillers: Where cabinets do not fit tight to adjacent construction, provide filler panels of matching construction and finish.

B. Countertops and Tabletops and Sinks: As specified in Section 12 36 00.

## 2.03 MATERIALS

A. VOC-Content-Restricted Products: VOC content not greater than required by the following:

1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Aerosol Adhesives: GreenSeal GS-36.
3. Joint Sealants: SCAQMD 1168 Rule.
4. Stains and Coatings: Most stringent of the following:
  - a. 40 CFR 59, Subpart D.
  - b. SCAQMD 1113 Rule.
  - c. CARB (SCM).

B. Wood-Based Materials:

1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
  - a. Exposed Material: Red Oak, FAS Grade.
  - b. Semi-Exposed Material: Red Oak, Select Grade.
2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.
  - a. Partical Board Core Panels: 3-ply particle board, grade 1-M-2 minimum, 48 lb. density.
  - b. Veneer Core Panels: 7-ply minimum (3/4 inch thick panels), 9-ply minimum (1 inch thick panels) and 13-ply minimum (1½ inch thick panels) with cross and face plies bonded with Type II water-resistant glue.
  - c. Exposed Surfaces: Plain sliced red oak veneer, HPVA HP-1 Grade AA; clear, compatible grain and color, no defects; book matched, running matched, vertical grain.
  - d. Semi-Exposed Surfaces: Same species as exposed, plain sliced; HPVA HP-1, Grade B.
  - e. Edgebanding: 3mm hardwood; same species as panel face veneers; on all edges of doors and drawer fronts, front edges of shelves and vertical divider panels, and front edges of base, wall and tall cabinet cases.
3. Concealed Solid Wood or Composite Wood Panels: Any species and without defects affecting strength or utility.

C. Finish For Wood-Based Materials: Water-based, high-performance acrylic urethane complying with SEFA 8W requirements for chemical resistance when tested in both horizontal and vertical orientation.

1. Finish Performance: Provide finish on all surfaces having chemical resistance of Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8W and no visible effect when surface is exposed to:
  - a. Hot water at temperature between 190 degrees F and 205 degrees F trickled down the test surface at 45 degree angle for 5 minutes.
  - b. Constant moisture in the form of 2 by 3 by 1 inch thick cellulose sponge kept continually saturated with water and in contact with test surface for 100 hours.

2. Appearance: Clear satin sheen; not cloudy or muddy. Provide stain color to approximate color of Owner's existing wood laboratory casework control sample.

D. Hardboard: ANSI A135.4, Class 1, tempered.

E. Cabinet Hardware: Manufacturer's standard styles, exposed components stainless steel.

1. Finish of Exposed Components: Satin chrome finish.
2. Locks: Lock with 5 pin cylinder and 2 keys per lock; ANSI/BHMA A156.11, Grade 1.
  - a. Lock For Paired Cabinet Doors: CompX National Double Door Lock Type 250: [www.compx.com](http://www.compx.com). Provide for cabinets of any height having paired doors.
  - b. Slide Bolt Lock For Tall Cabinets: CompX Timberline System 260 Wardrobe Lock: [www.compx.com](http://www.compx.com). Provide for all cabinets over 48 inches tall. Install on right-hand leaf of cabinets with paired doors.
  - c. Latch For Paired Doors on Tall Cabinets: CompX Timberline DL series Double Door Latch: [www.compx.com](http://www.compx.com). Provide DL-200 at top and DL-300 at bottom of cabinet.
  - d. Provide one lock (1) per drawer and one lock (1) per cabinet.
    - 1) For paired cabinet doors up to 48" high, provide double door lock lock on right-hand leaf.
    - 2) For paired cabinet doors taller than 48" high, provide specified wardrobe lock on right-hand leaf and double door latches at top and bottom of cabinet to secure left-hand leaf.
  - e. Strikes: Provide to match specified lock requirements. Notching or routing of cabinet panel is acceptable where appropriate to the specified lock application/operation.
  - f. Keying:
    - 1) Key doors and drawers in perimeter cabinets in Biology Labs 45 and 64 alike across both rooms.
    - 2) Key doors and drawers in student island stations in Biology Labs 45 and 64 alike across both rooms.
    - 3) Key doors and drawers in Prep Room 46 alike.
  - g. Provide two keys per lock and six master keys.
3. Shelves:
  - a. Shelf Standards and Brackets: Vertical steel standards with rubber button fitted steel brackets; epoxy-coated, complying with BHMA A156.9, Types B04102 and B04112,
  - b. Cabinet Shelf Supports: Metal pins in holes bored at 32mm centers.
4. Swinging Doors:
  - a. Hinges: Offset pin, 5-knuckle, institutional style, hospital tipped. Provide two hinges for doors up to 48 inches high; three hinges for doors over 48 inches high.
  - b. Catches: Mechanical catch.
  - c. Pulls: Satin chrome or brushed nickel 10 mm (3/8 inch) dia wire pulls, 4 inches wide.
5. Drawers:
  - a. Pulls: Satin chrome or brushed nickel 10 mm (3/8 inch) dia. wire pulls, 4 inches wide.
  - b. Slides: Steel, full extension arms, ball bearings; capacity as recommended by manufacturer for drawer height and width.
6. Label Holders: Steel; anachrome finish; for 2 inch x 1 inch label cards; Knappe & Vogt #701 ANO. Provide on each door and drawer.
7. Pullboard Slides: Epoxy-coated steel; 3/4 extension, open roller, 75 lb. dynamic load, with hold open feature.

## 2.04 SERVICE FITTINGS AND FIXTURES

- A. Manufacturers:
  - 1. WaterSaver Faucet Co.: [www.wsflab.com](http://www.wsflab.com).
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Provide units that comply with SEFA 7, complete with washers locknuts, nipples, and other installation accessories. Include panel and deck flanges, escutcheons and index color coding disks.
- C. Water Outlets: Forged brass body; self-contained compression valve unit with replaceable stainless steel seat; integral vacuum breaker; forged brass cross handles; polished chrome plated finish. Provide blade handles in lieu of cross handles at all ADA-compliant sink locations.
  - 1. Type WM1: Mixing faucet; deck-mounted; 8 inch rigid gooseneck; removable serrated hose end; integral handles with red "HW" and green "CW" index color disks.
  - 2. Type WD1: Deionized Water Faucet: Deck-mounted; inert polypropylene lining; 8 inch rigid gooseneck, removable serrated hose end; knurled handle on right side with white "DI" index disk. At ADA-compliant sink locations, provide self-closing lever handle. Product: WaterSaver #L7853-RH(-LE at ADA-compliant locations).
- D. Escutcheons: Brass or stainless steel, with finish to match fittings and fixtures.

## 2.05 ACCESSORIES

- A. Electrical Outlet Covers: Stainless steel.
- B. Security Rings: Polished stainless steel U-bolt with (2) stainless steel counter flange plates; 78 mm overall u-bolt length; 36 mm center-to-center of legs; 6 mm diameter; 30 mm projection height above counter; with (2) stainless steel security nuts.
- C. Sealant For Use in Casework Construction: Manufacturer's recommended type.

## 2.06 FABRICATION

- A. Base Cabinet Units:
  - 1. End Panels: 3/4 inch thick particle board or veneer core panel; bore interior faces, as appropriate, for security panels, rails, and shelf support holes; provide levelers unless leveling will be accomplished by shimming units in field.
  - 2. Full Top Frame:
    - a. Horizontal Front Top Rail: 1 inch x 3 inch exposed solid wood or edge banded 9-ply minimum veneer core plywood.
    - b. Vertical Back Top Rail: 3/4 inch x 3¾ inch solid wood or veneer core panel.
    - c. Top side rails: 3/4 inch x 1½ inch solid wood between front horizontal and back vertical rails.
  - 3. Front Horizontal Intermediate Rail: 3/4 inch x 1½ inch exposed solid wood; provide between doors and drawers.
  - 4. Intermediate Rear Rails: 3/4 inch x 1½ inch solid wood rail; provide where security panels are specified.
  - 5. Toe Space Rails: 3/4 inch x 3¾ inch solid wood or veneer core panel, mounted between end panels, forming a 4" high x 2½ inch deep toe space, closed to cupboard bottom.



6. Bottom Panels: 3/4 inch thick particle board core or veneer core panel, set flush with cabinet end panels. Fabricate suspended unit bottoms of 1 inch thick panel material. Removable bottoms are not acceptable.
  7. Back Panels:
    - a. Cupboard Units: One-piece 1/4 inch thick hardboard, rabbetted into rear top rail for easy removal from inside of cabinet.
    - b. Drawer Units: Removable 1/4 inch thick hardboard split back panels, rabbetted into top rail.
    - c. Sink units: Half height, one-piece 1/4 inch thick hardboard, rabbetted into rear rail for easy removal from inside of cabinet.
  8. Vertical Dividers In Combination Cabinets: 1½ inch thick veneer core panels; frames not acceptable.
  9. Security panels: 1/4 inch thick hardboard panel rabbetted into front and rear rails and end panels; provide between drawers with locks and above doors on units with locks.
  10. Shelves: 1 inch thick veneer core plywood; adjustable on 32mm centers; anti-roll lips at front edge.
    - a. Depth: 17¾ inches.
  11. Drawer construction:
    - a. Box: Four-sided drawer box with back, front and sides of 12mm (1/2 inch nominal) 9-ply birch plywood with chemical resistant finish and finished top edges. Three-sided drawer box attached to outer drawer front is not acceptable.
    - b. Box Corner Joinery: Manufacturer's option.
      - 1) Lock joint, glued and pinned.
      - 2) Multiple dovetail.
    - c. Bottom: Manufacturer's option; nominal 1/4 inch thick material, inset into all four sides of drawer box and sealed with hot melt glue process around entire drawer bottom perimeter. Staples are not acceptable.
      - 1) White coated MDF board.
      - 2) Tempered hardboard, smooth side up.
      - 3) White PVC clad MDF board.
    - d. Divider Grooves: As indicated on Drawings.
  12. Door Panels and Removable Drawer Front Panels: 3/4 inch thick particleboard core panel.
  13. Fillers, Kneespace Panels, Scribes, etc.: 3/4 inch thick; same species and grade as adjacent exposed surfaces; veneer core panel or solid wood.
  14. Pullboards: 1 inch thick veneer core panel with balanced laminated faces; front constructed same as a drawer front with gaps and grain as specified for cabinet face exterior.
- B. Wall, Upper and Tall Case Units: Fabricate of materials specified for base units, except as noted below:
1. Top Panels: 1 inch thick, veneer core panel.
  2. Bottom Panels:
    - a. Wall and Upper Case Units: 1 inch thick veneer core panel.
    - b. Tall Case Units: 1 inch thick veneer core panel.
  3. Exposed Back Panels: 1/4 inch thick veneered MDF plywood with backs recessed 7/8" and set into top, bottom and end panels, sealed with hot melt glue process around entire perimeter.
  4. Semi-Exposed Back Panels: Manufacturer's option; recessed 7/8" and set into top, bottom and end panels, sealed with hot melt glue process around entire perimeter.

- a. 1/4 inch thick veneered MDF plywood.
  - b. 1/4 inch thick hardboard.
  5. Shelves: 1 inch thick veneer core panel; adjustable on 32mm centers.
  6. Fixed Shelves In Tall Case Units: 1 inch thick veneer core panel.
  7. Framed Glass Doors: Solid wood, 3/4 inch x 2<sup>3</sup>/<sub>4</sub> inch frame stock, machined to accept glass, mitered joints, extruded vinyl retaining molding to allow glass to be replaced without tools.
- C. Table Frames:
1. Perimeter Rails: 3/4 inch x 4-5/16 inch solid wood or veneer core panel with attached steel corner braces, grooved and screwed into both rails at each corner.
  2. Reinforcing Cross Rails: 3/4 inch veneer core panel, doweled, glued and pinned into perimeter rails at intervals not more than 33 inches on center in tables without drawers.
  3. Separate Cross Rails: 3/4 inch x 4-5/16 inch solid wood or veneer core panel with attached steel brackets at both ends.
  4. Legs: 2<sup>1</sup>/<sub>2</sub> inch x 2<sup>1</sup>/<sub>2</sub> inch solid wood, with 3/8-16 x 3-1/2 inch hanger bolt inserted 1<sup>3</sup>/<sub>4</sub> inches into leg and fastened to perimeter rail corner brace.
  5. Leg rails (if required): 1<sup>1</sup>/<sub>4</sub> inch x 2<sup>1</sup>/<sub>2</sub> inch solid wood mortised into legs and secured with a 3/8-16 x 5 inch long stove bolt.
  6. Leg Shoes: Black rubber or vinyl with provision for floor clip.
- D. Finish: Factory-finish all exposed and semi-exposed surfaces with the same finish.
1. Preparation: Wood sanded smooth, free from dust and mill marks.
  2. Stain: Single application of clean, manufacturer-recommended stain of selected color; tinted coating not acceptable.
  3. Coating: Apply in accordance with manufacturer instructions, force-dry, sand and wipe clean.
  4. Coats: Multiple coats as required to achieve minimum 1.5 mil dry film thickness.
  5. Appearance: Clear satin gloss; not cloudy or muddy.
- E. Fixture Locations: Cut and drill counter tops, backs, and other components for service outlets and fixtures.
- F. Access Panels: Provide access panels for maintenance of utility service and mechanical and electrical components.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify adequacy of support framing and anchors.
- B. Verify that service connections are correctly located and of proper characteristics.

### **3.02 INSTALLATION**

- A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.3.
- B. Use anchoring devices to suit conditions and substrate materials encountered.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler panels where necessary to close gaps.

- E. Fasten continuous cabinets together with joints flush, tight and uniform.
- F. Secure wall cabinets to solid supporting material.
- G. Install accessories and service fittings in accordance with manufacturer's recommendations. Turn screws to seat flat; do not drive.
- H. Replace units that are damaged, including those that have damaged finishes.

### **3.03 TOLERANCES**

- A. Maximum variation from alignment of adjacent casework units: 1/32 inch.

### **3.04 ADJUSTING**

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures, to function smoothly.

### **3.05 CLEANING**

- A. Clean all components and remove dust and debris from all drawer boxes and cabinet compartments.

### **3.06 PROTECTION**

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

**END OF SECTION**

**SECTION 12 36 00  
COUNTERTOPS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.
- B. Countertops for laboratory casework and table frames.
- C. Shelves for standards and brackets.
- D. Wall-hung counters.
- E. Epoxy resin sinks.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 41 00 - Custom Casework.
- B. Section 11 53 00 - Laboratory Equipment: Work surfaces inside fume hoods.
- C. Section 12 35 53.19 - Wood laboratory Casework: Cabinets, table frames, shelf standards and brackets.

**1.03 REFERENCE STANDARDS**

- A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- G. PS 1 - Structural Plywood; 2009.

**1.04 SUBMITTALS**

- A. 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.
- B. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

- 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. Installation Instructions: Manufacturer's installation instructions and recommendations.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

### **1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.
- B. Installer Qualifications: Certified by Fabricator.

### **1.06 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.

### **1.07 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**

### **2.01 COUNTERTOPS**

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS).
- B. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
  - 1. Manufacturers:
    - a. Durcon, Inc: [www.durcon.com](http://www.durcon.com).
    - b. LOC Scientific, Inc.: [www.locscientific.com](http://www.locscientific.com).
    - c. OnePointe Solutions (ChemTops): [www.chemtops.com](http://www.chemtops.com).
    - d. Prime Industries, Inc: [www.piilab.com](http://www.piilab.com).
    - e. Total Laboratory Solutions: [www.duratop-epoxy.com](http://www.duratop-epoxy.com).
  - 2. Flat Surface Thickness: 1 inch, nominal.
  - 3. Flammability: Self-extinguishing, when tested in accordance with ASTM D635.
  - 4. Surface Finish: Smooth, non-glare.
  - 5. Color: Black.
  - 6. Exposed Edge Shape: 1/8 inch bevel chamfer.
  - 7. Drip Edge: Drip groove 1/8 inch wide and deep, located 1/2 inch back from edge on underside of all exposed edges.
  - 8. Back and End Splashes: Same material, same thickness; separate for field attachment.

9. Sinks: Same material, same color; molded in one piece with sloped rabbeted lip sealed to countertop; bottom sloped to outlet; molded outlets; drain outlet located in back corner.
    - a. Sides and Ends: 1/2 inch minimum thickness.
    - b. Bottoms: 5/8 inch minimum thickness.
    - c. Interior Corners: 1 inch minimum radius.
    - d. Clamping collars for 1-1/2 or 2 inch diameter waste pipe, for sealed but not permanent connection.
    - e. Steel channel supports front to back on each side, fastened to underside of top to support twice full sink weight.
  10. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.
- C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Flat Sheet Thickness: 1/4 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. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - c. Color and Pattern: As selected by Owner 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; square edge.
  5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
  6. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.

## 2.02 ACCESSORY MATERIALS

- A. Wood-Based Components:
  1. Wood fabricated from old growth timber is not permitted.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- E. Joint Sealant: Mildew-resistant silicone sealant, clear.
- F. Grommets for Holes in Countertops: Molded plastic; matching caps with slots for wire passage. Color(s) as selected by Owner from manufacturer's fill line.
- G. Support Brackets: 2 x 2 1/4 inch thick painted steel construction.
  1. Manufacturers:
    - a. A&M Hardware, Inc.: [www.aandmhardware.com](http://www.aandmhardware.com).

- b. Rakks/Rangine Corporation: [www.rakks.com](http://www.rakks.com).
- 2. Products:
  - a. Counters Up To 18 Inches Deep:
    - 1) A&M #C-12.
    - 2) Rakks #EH-1212.
  - b. Counters 19 To 24 Inches Deep:
    - 1) A&M #C-18.
    - 2) Rakks #EH-1818.
  - c. Counters 25 To 30 Inches Deep:
    - 1) A&M #C-24.
    - 2) Rakks #EH-2424.
- 3. Use A&M brackets or Rakks "Flush Mount" configuration (vertical leg concealed in wall) at drywall locations and where indicated on Drawings.

## **2.03 FABRICATION**

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

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION**

- A. Securely attach solid surface countertops to cabinets and brackets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach epoxy resin countertops using compatible adhesive.
- C. Seal joint between back/end splashes and vertical surfaces.

### **3.04 TOLERANCES**

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

### **3.05 CLEANING**

- A. Clean countertops surfaces thoroughly.

### **3.06 PROTECTION**

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

**END OF SECTION**



**SECTION 21 05 00  
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

A. Section 07 84 00 - Firestopping.

B. Section 21 13 00 - Fire Suppression Sprinklers: Sprinkler systems design.

**1.03 REFERENCE STANDARDS**

A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

F. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2013.

G. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

I. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

J. AWWA C606 - Grooved and Shouldered Joints; 2011.

K. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

**1.04 QUALITY ASSURANCE**

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

B. Installer Qualifications: Company specializing in performing work of the type specified this section.

C. Conform to UL and FM requirements.

**1.05 DELIVERY, STORAGE, AND HANDLING**

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

## **PART 2 PRODUCTS**

### **2.01 FIRE PROTECTION SYSTEMS**

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

### **2.02 ABOVE GROUND PIPING**

- A. Steel Pipe: Schedule 40, black.
  - 1. Steel Fittings: ASTM A234/A234M, wrought carbon steel or alloy steel or ASME B16.5, steel flanges and fittings.
  - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
  - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
  - 4. 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.

### **2.03 ESCUTCHEONS**

- A. Material:
  - 1. Fabricate from nonferrous metal.
  - 2. Chrome-plated.
  - 3. Metals and Finish: Comply with ASME A112.18.
- B. Construction:
  - 1. One-piece for mounting on 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.

### **2.04 PIPE HANGERS AND SUPPORTS**

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

### **2.05 MECHANICAL COUPLINGS**

- A. Rigid Mechanical Couplings for Grooved Joints:
  - 1. Dimensions and Testing: Comply with AWWA C606.
  - 2. Minimum Working Pressure: 300 psig.
  - 3. Housing Material: Fabricate of ductile iron conforming to ASTM A536.
  - 4. Housing Coating: Factory applied orange enamel.
  - 5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
  - 6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

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

### **3.02 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.
- 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. Do not penetrate building structural members unless indicated.
- 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.

### **3.03 CLEANING**

- A. Upon completion of work, clean all parts of the installation.

- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

**END OF SECTION**

**SECTION 21 13 00  
FIRE SUPPRESSION SPRINKLERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.
- C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.03 REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.
- C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - 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. Shop Drawings:
  - 1. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
  - 2. Submit shop drawings to Authority Having Jurisdiction for approval. Submit proof of approval to Architect/Engineer.
- D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - 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.

**1.05 QUALITY ASSURANCE**

- A. Conform to UL (DIR) requirements.

- B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located. Or a holder of a valid NICET level III or IV Sprinkler Technician.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience approved by manufacturer.
- E. Equipment and Components: Provide products that bear UL (DIR) label or marking.

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

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

## **PART 2 PRODUCTS**

### **2.01 SPRINKLER SYSTEM**

- A. Sprinkler System: Provide coverage for building areas noted.
- B. Water Supply: Determine volume and pressure from water flow test data.
- C. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

### **2.02 SPRINKLERS**

- A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Chrome plated.
  - 4. Escutcheon Plate Finish: Chrome plated.
  - 5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- B. Exposed Area Type: Pendant type with guard.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Brass.
  - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Chrome plated.
  - 4. Escutcheon Plate Finish: Chrome plated.
  - 5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- D. Guards: Finish to match sprinkler finish.

## **2.03 STAINLESS STEEL FLEXIBLE DROPS**

- A. Manufacturers:
  - 1. Flex Head Industries, Inc.
  - 2. Aqua Flex.
  - 3. Victaulic Company.
- B. In lieu of rigid pipe offsets or return bends. Braided type 304 stainless steel flexible tube with male threaded pipe nipple for connection to branchline piping, and a zinc plated steel reducer with a 1/2" or 3/4" NPT female thread for connection to a sprinkler head. The hoses shall be factory-pressure tested to 400 psi.
- C. Flexible drop shall attach to the ceiling grid with open gate bracket and can be installed without the use of special tools.
- D. The braided drop shall be FM approved for sprinkler services to 200 psi.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. 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. Install guards on sprinklers .
- I. Hydrostatically test entire system.
- J. Require test be witnessed by Authority Having Jurisdiction.

### **3.02 INTERFACE WITH OTHER PRODUCTS**

- A. Ensure required devices are installed and connected as required to fire alarm system.

### **3.03 SCHEDULES**

- A. System Hazard Areas:
  - 1. Offices: Light Hazard.
  - 2. Classrooms: Light Hazard.
  - 3. Science Classrooms: Ordinary Hazard, Group 2.
  - 4. Equipment and Storage Rooms: Ordinary Hazard, Group 2.
  - 5. Other Areas: In accordance with NFPA 13.

**END OF SECTION**

**SECTION 22 05 53**  
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

**1.02 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Project Record Documents: Record actual locations of tagged valves.

**PART 2 PRODUCTS**

**2.01 IDENTIFICATION APPLICATIONS**

- A. Major Control Components: Nameplates.
- B. Piping: Pipe markers.
- C. Valves: Tags.

**2.02 NAMEPLATES**

- A. Manufacturers:
  - 1. Kolbi Pipe Marker Co..
  - 2. Seton Identification Products.
  - 3. Brimer Industries.
  - 4. Craftmark Identification Systems.
- B. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: Black.
  - 2. Letter Height: 1/2 inch.
  - 3. Background Color: White.
  - 4. Plastic: Conform to ASTM D709.

**2.03 TAGS**

- A. Manufacturers:
  - 1. Kolbi Pipe Marker Co..



2. Seton Identification Products.
  3. Brimer Industries.
  4. Craftmark Identification Systems.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

## **2.04 PIPE MARKERS**

- A. Manufacturers:
1. Kolbi Pipe Marker Co..
  2. Seton Identification Products.
  3. Brimer Industries.
  4. Craftmark Identification Systems.
- B. Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### **3.02 INSTALLATION**

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Use tags on piping 3/4 inch diameter and smaller.
- F. Identify pipe markers indicating service, flow direction, and pressure.
- G. Install pipe markers in clear view and align with axis of piping.
- H. Location of pipe identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

**END OF SECTION**

**SECTION 22 07 19  
PLUMBING PIPING INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Piping insulation.
- B. Jackets and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

**1.03 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

**1.05 QUALITY ASSURANCE**

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.
- B. Comply with the Midwest Insulation Contractors Association "National Commercial and Industrial Insulation Standards".

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

**1.07 FIELD CONDITIONS**

- A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

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

### **2.02 GLASS FIBER**

A. Manufacturers:

1. CertainTeed Corporation.
2. Johns Manville Corporation.
3. Knauf Insulation.
4. Owens Corning Corp.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 650 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

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

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

### **2.03 LAVATORY PIPE INSULATION**

A. Manufacturer:

1. Plumberex.
2. Brocar.
3. Truebro.

B. Insulation: Fully molded closed cell vinyl, fit to lavatory P-trap, tailpiece and angle valve stop assemblies. Vinyl shall be antimicrobial with UV inhibitors and utilize reusable fasteners.

### **2.04 JACKETS**

A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
  - a. Minimum Service Temperature: 0 degrees F.
  - b. Maximum Service Temperature: 150 degrees F.
  - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
  - d. Thickness: 10 mil.
  - e. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints. All hangers, supports, anchors and other projections that are in contact to cold surfaces shall be insulated and vapor sealed to prevent condensation.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. 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.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. 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.
- I. Inserts and Shields:
  - 1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 2. Insert Location: Between support shield and piping and under the finish jacket.
  - 3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 4. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

K. Apply insulation at pipe hangers and supports according to National Commercial and Industrial Standards Plate Numbers 5, 6 and 7.

### **3.03 SCHEDULES**

#### **A. Plumbing Systems:**

1. Domestic Hot Water Supply:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: Up to and including 2 inch.
    - a) Thickness: 1 inch.
2. Domestic Hot Water Recirculation:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: All sizes.
    - a) Thickness: 1 inch.
3. Domestic Cold Water:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: All sizes.
    - a) Thickness: 1 inch.
4. Lavatory Piping:
  - a. Closed Cell Vinyl.
    - 1) Thickness: 3/16 inch.

**END OF SECTION**

**SECTION 22 10 05  
PLUMBING PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pipe, pipe fittings, valves, and connections for piping systems.
  - 1. Sanitary sewer.
  - 2. Domestic water.
  - 3. Gas.
  - 4. Flanges, unions, and couplings.
  - 5. Pipe hangers and supports.
  - 6. Valves.
  - 7. Flow controls.
  - 8. Check.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- C. Section 22 07 19 - Plumbing Piping Insulation.
- D. Section 31 23 16 - Excavation.
- E. Section 31 23 16.13 - Trenching.
- F. Section 31 23 23 - Fill.

**1.03 REFERENCE STANDARDS**

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- D. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2011.
- E. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- I. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

- K. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.
- L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.
- M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).
- N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
- O. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.
- P. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- Q. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.
- R. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).
- S. AWWA C651 - Disinfecting Water Mains; 2005.
- T. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.
- U. 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.
- V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
- W. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.
- X. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
- Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- Z. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- AA. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- AB. Safe Drinking Water Act, Section 1417 - Lead Free: Refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content  $\leq 0.25\%$ , Amended January 4, 2011.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - 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.

C. Project Record Documents: Record actual locations of valves.

### **1.05 QUALITY ASSURANCE**

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body. Manufacturers lead free marking on valve body.

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

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### **1.07 FIELD CONDITIONS**

A. Do not install underground piping when bedding is wet or frozen.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

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

### **2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

### **2.03 SANITARY SEWER PIPING, ABOVE GRADE**

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, solvent.

2. Joints: ASTM B32, alloy Sn50 solder.



- C. PVC Pipe: ASTM D2729.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

#### **2.04 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.
  - 3. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements. Sealing elements shall be factory installed by fitting manufacturer. Press ends shall have means to indicate non-pressed fitting during pressure testing.
    - a. Manufacturers:
      - 1) Viega LLC.
      - 2) Nibco.

#### **2.05 NATURAL GAS PIPING, ABOVE GRADE**

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
  - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
  - 2. Joints: Threaded or welded to ASME B31.1.

#### **2.06 FLANGES, UNIONS, AND COUPLINGS**

- A. Unions for Pipe Sizes 3 Inches and Under:
  - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
  - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
  - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

#### **2.07 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.
  - 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
  - 6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
    - a. Bases: High density polypropylene.

- b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
  - e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
- B. Plumbing Piping - Drain, Waste, and Vent:
- 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 4. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
  - 5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
- 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 4. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
  - 5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- D. Plumbing Piping - Gas:
- 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

## **2.08 BALL VALVES**

- A. Manufacturers:
- 1. Milwaukee Valve Company.
  - 2. Nibco, Inc; T/S-585-66-LF.
  - 3. Watts.
  - 4. Apollo.
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze body, 304 stainless steel ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, threaded, or grooved ends.

## **2.09 PLUG VALVES**

- A. Manufacturers:
- B. Up to and including 2 Inches (50 mm): bronze body, bronze tapered plug, non-lubricated, teflon packing, screwed ends.
- C. Construction 2-1/2 Inches and Larger: 1, 175 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

## **2.10 FLOW CONTROLS**

- A. Manufacturers:
  - 1. Griswold Controls.
  - 2. ITT Bell & Gossett.
  - 3. Taco, Inc.
  - 4. Armstrong.
- B. Construction: Class 125, Lead free, brass or bronze body with union on inlet , temperature and pressure test plug on inlet .
- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

## **2.11 SWING CHECK VALVES**

- A. Manufacturers:
  - 1. Milwaukee Valve Company.
  - 2. Nibco, Inc; S-413-Y-LF.
  - 3. Watts.
- B. Up to 2 Inches:
  - 1. MSS SP-139, 300 CWP, silicon bronze (ASTM Listed and corrosion resistant) body and cap designed for horizontal or vertical (flow in upward direction) flow, PFTE or TFE swing disc with rubber seat, solder ends.

## **2.12 STRAINERS**

- A. Size 2 inch and Under:
  - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
  - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that excavations are to required grade, dry, and not over-excavated.

### **3.02 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.
- D. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed.
- H. Establish elevations of buried piping outside the building to ensure not less than 5 ft of cover.
- I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- J. Excavate in accordance with Section 31 23 16.
- K. Backfill in accordance with Section 31 23 23.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- N. 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.
- O. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- P. Sleeve pipes passing through partitions, walls and floors.
- Q. Pipe Hangers and Supports:
  1. Support horizontal piping as scheduled.
  2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  3. Place hangers within 12 inches of each horizontal elbow.
  4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  6. Provide copper plated hangers and supports for copper piping.
  7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
  8. Support cast iron drainage piping at every joint.

### **3.04 APPLICATION**

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

- D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install globe or ball valves for throttling, bypass, or manual flow control services.
- F. Provide plug valves in natural gas systems for shut-off service.
- G. Provide flow controls in water recirculating systems where indicated.

### **3.05 TOLERANCES**

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### **3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### **3.07 SERVICE CONNECTIONS**

- A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

### **3.08 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.
- d. Pipe size: 4 inches to 6 inches:
  - 1) Maximum hanger spacing: 10 ft.
  - 2) Hanger rod diameter: 5/8 inch.
2. Plastic Piping:
  - a. All Sizes:
    - 1) Maximum hanger spacing: 6 ft.
    - 2) Hanger rod diameter: 3/8 inch.

**END OF SECTION**

**SECTION 22 10 06  
PLUMBING PIPING SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Drains.
- B. Cleanouts.
- C. Hydrants.
- D. Refrigerator valve and recessed box.
- E. Water hammer arrestors.
- F. Mixing valves.
- G. Air vents.
- H. Vacuum relief valves.
- I. Gas solenoid enclosures.

**1.02 RELATED REQUIREMENTS**

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 40 00 - Plumbing Fixtures.

**1.03 REFERENCE STANDARDS**

- A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).
- B. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- C. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.
- D. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- E. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- F. PDI-WH 201 - Water Hammer Arresters; 2010.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, \_\_\_\_\_.
- D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Loose Keys for Outside Hose Bibbs: One.

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

- A. Accept specialties on site in original factory packaging. Inspect for damage.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

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

### **2.02 DRAINS**

- A. Manufacturers:
1. MIFAB.
  2. Jay R. Smith Manufacturing Company.
  3. Zurn Industries, Inc.
- B. Floor Drain (FD-1):
1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and 6 inch round, adjustable stainless steel (nickel-bronze) strainer.
  2. MIFAB; Model F1000-C-6-3

### **2.03 CLEANOUTS**

- A. Manufacturers:
1. MIFAB.
  2. Jay R. Smith Manufacturing Company.
  3. Zurn Industries, Inc.
- B. Cleanouts at Interior Finished Floor Areas FCO:
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded scoriated secured stainless steel (nickel bronze) top, and bronze gasketed plug.
  2. MIFAB; Model C1220-34B-R-3.
- C. Cleanouts at Interior Finished Wall Areas:
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
  2. MIFAB; Model C1450-RD.
- D. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.
1. MIFAB; Model C1460.

### **2.04 HYDRANTS**

- A. Manufacturers:
1. MIFAB.
  2. Jay R. Smith Manufacturing Company.
  3. Zurn Industries, Inc.



4. Woodford.
- B. Wall Hydrants (H-1):
1. ASSE 1019; freeze resistant, self-draining type with stainless steel wall plate, enclosed in a flush mounted wall box, hose thread spout, lockshield and removable key, and integral vacuum breaker.
  2. MIFAB; Model MHY-26-3.

## **2.05 REFRIGERATOR VALVE AND RECESSED BOX (IB-1)**

- A. Box Manufacturers:
1. IPS Corporation/Guy Gray; Model MIB.
  2. Oatey Supply Chain Services, Inc.
- B. Valve Manufacturers:
1. IPS Corporation/Water-Tite.
  2. Zurn Industries, LLC.
- C. Description: Recessed 18 gauge metal box and faceplate, white powder coated with chrome plated quarter-turn valve.

## **2.06 WATER HAMMER ARRESTORS**

- A. Manufacturers:
1. MIFAB.
  2. Jay R. Smith Manufacturing Company.
  3. Zurn Industries, Inc.
- B. Water Hammer Arrestors:
1. Stainless steel construction, bellows 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. MIFAB; Model WHB.

## **2.07 AIR VENTS**

- A. Manufacturers:
1. Armstrong International, Inc.
  2. ITT Bell & Gossett.
  3. Taco, Inc.
- B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. Float Type:
1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
  2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

## **2.08 VACUUM RELIEF VALVES**

- A. Manufacturers:
  - 1. Watts Regulator Co.; ; Model Series N36.
  - 2. ITT Bell & Gossett.
  - 3. Taco, Inc.
- B. Automatically vents a closed system if vacuum occurs. Tested and rated under ANSI Z21.22 - Relief Valves for Hot Water Supply Systems. Opens at less than 1/2 inch vacuum with venting capacity of 15 cubic feet per minute.

## **2.09 MIXING VALVES**

- A. Thermostatic Mixing Valve (TMV-1):
  - 1. Manufacturers:
    - a. Powers; Model ETV 200 .
    - b. Leonard Valve Company.
    - c. Lawler.
  - 2. Valve: ASSE 1071; rough bronze body, thermal actuator for supplying tepid water to emergency fixtures, integral temperature adjustment, and cold water bypass to ensure flow in the event of valve failure or loss of hot water supply.
  - 3. Accessories:
    - a. Stem thermometer on outlet.
    - b. Strainer stop checks on inlets.
  - 4. Capacity: 32.9 gpm at 30 psi differential. Valve shall perform down to 3.0 gpm.

## **2.10 GAS SOLENOID ENCLOSURE (GS-1)**

- A. Manufacturers;
  - 1. Isimet; Model S-series enclosure.
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pre-assembled gas solenoid enclosure with threaded ball valves, unions and solenoid valves rated for natural gas. Valves shall be wired and controlled by utility controller provided in Division 16.
- C. Enclosure: Recessed, white powder coated, NEMA 1 enclosure with keyed lock and rubber grommets for piping inlet and outlet holes.
- D. Solenoid valves: One UL listed valve, 3/4 inch, aluminum construction designed for low pressure natural gas application. Normally closed, zero differential allowing the valve to open and close without the presence of flow.
  - 1. Maximum operating temperature: 180 degrees F.
  - 2. Coil rating: continuous duty totally encapsulated.
  - 3. Voltage tolerances: +10%, -15% at applicable voltage, 120V.
  - 4. Solenoid coils: NEMA 1 rated.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Install floor cleanouts at elevation to accommodate finished floor.
- D. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to plumbing fixtures.

**END OF SECTION**

**SECTION 22 30 00  
PLUMBING EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Water heaters.
- B. Compression tanks.
- C. Deionization equipment.

**1.02 REFERENCE STANDARDS**

- A. ANSI Z21.10.3 - Gas-Fired Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous; 2014.
- B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.
- C. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.
- D. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Provide electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

**1.04 QUALITY ASSURANCE**

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

**1.05 CERTIFICATIONS**

- A. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

## **PART 2 PRODUCTS**

### **2.01 WATER HEATER MANUFACTURERS**

- A. A.O. Smith Water Products Co.
- B. Rheem Manufacturing Company.
- C. State Industries.
- D. Bradford White

### **2.02 CERTIFICATIONS**

- A. Water Heaters: NSF approved.
- B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

### **2.03 COMMERCIAL ELECTRIC WATER HEATERS**

- A. Type: Factory-assembled and wired, electric, vertical storage.
- B. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
- C. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
- D. Accessories: Provide:
  - 1. Water connections: Brass.
  - 2. Dip tube.
  - 3. Drain Valve.
  - 4. Anode: Magnesium.
  - 5. Temperature and Pressure Relief Valve: ASME labelled.
- E. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 Watts per square inch.

### **2.04 DIAPHRAGM-TYPE COMPRESSION TANKS**

- A. Manufacturers:
  - 1. Amtrol Inc; Model ST-5C.
  - 2. Bell & Gossett.
  - 3. Watts.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.
- D. Size: 8 inches diameter, 14 inches overall length, 0.9 gal acceptance capacity.

## **2.05 DEIONIZATION EQUIPMENT**

- A. Mixed Bed Tanks: Deionization tanks capable of producing up to 18.2 MEGOHM-CM resistivity at 77 degrees F. Flow capacity shall be 1.0 gpm. Size of tank shall be 8 inches in diameter and 20.5 inches high.
  - 1. Manufacturers:
    - a. Evoqua Water Technologies.
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Quality Meter: Noryl body, Inline meter, plus or minus 10% accuracy at 77 degrees F, gold plated electrodes, viton o-ring, lexan cover, visual indication lights, 115 VAC, and 150 psi maximum operating pressure.
  - 1. Manufacturers:
    - a. Thornton: Model 656.
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Pre Filter: Polypropylene filter housing with reinforced polypropylene cap, pre-washed finely pulverized activated carbon encapsulated in a depth filtration media of highly purified alpha-cellulose and synthetic fibers for chlorine removal. Thermally bonded outer layer, nominal 10 microns for depth filtration in one pass without carbon channeling or media migration. Flow capacity of 1 gpm.
- D. Final Filter:
  - 1. Polypropylene filter housing with reinforced polypropylene cap, pleated highly asymmetric hydrophilic polysulfone membrane over a non-woven polypropylene support layer. Material shall be factory rinsed with deionized water for quick on stream rinse up with minimum of throughput. Flow capacity of 1 gpm.
  - 2. Filter shall meet USP Class VI biological tests for plastics. Manufactured from materials that are FDA listed for food contact applications in CFR Title 21.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related electrical work to achieve operating system.

**END OF SECTION**

**SECTION 22 40 00  
PLUMBING FIXTURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Water closets.
- B. Lavatories.
- C. Sinks.
- D. Mop basins.
- E. Emergency showers.

**1.02 RELATED REQUIREMENTS**

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 10 06 - Plumbing Piping Specialties.

**1.03 REFERENCE STANDARDS**

- A. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).
- B. ASME A112.18.1 - Plumbing Supply Fittings; 2012.
- C. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.
- D. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- E. NSF 372 - Drinking Water System Components - Lead Content; 2011.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

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

**1.06 REGULATORY REQUIREMENTS**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

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

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

## **1.08 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

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

### **2.02 FLUSH VALVE WATER CLOSET (WC-1), ADAAG COMPLIANT**

- A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action.
  - 1. Bowl: ASME A112.19.2; 16.5 inches high with elongated rim.
  - 2. Flush Valve: Exposed (top spud).
  - 3. Flush Volume: 1.28 gallon, maximum.
  - 4. Flush Operation: Sensor operated.
  - 5. Handle Height: 11 inches or less.
  - 6. Supply Size: 1-1/2 inches.
  - 7. Outlet Size: Nominal 2 inches.
  - 8. Color: White.
  - 9. Manufacturers:
    - a. American Standard, Inc.
    - b. Sloan Valve Company; Model ST-2050.
    - c. Zurn industries, Inc
- B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
  - 1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
  - 2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
  - 3. Manufacturers:
    - a. Delany Products.
    - b. Sloan Valve Company; Model 8111.
    - c. Zurn Industries, Inc.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Seats:
  - 1. Manufacturers:
    - a. Bemis Manufacturing Company; Model 2155SSC.
    - b. Church Seat Company.
    - c. Olsonite.



2. Solid antimicrobial white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers:

1. Manufacturers:
  - a. MIFAB
  - b. J.R. Smith.
  - c. Zurn Industries, Inc.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

### **2.03 LAVATORY (L-1), ADAAG COMPLIANT**

A. Lavatory Manufacturers:

1. American Standard, Inc.
2. Sloan Valve Company: Model SS-3003.
3. Zurn industries, Inc.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, 20 by 18 inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.

1. Drilling Centers: 4 inch.

C. Supply Faucet Manufacturers:

1. T & S Brass and Bronze Works, Inc.
2. Chicago Faucet.
3. Sloan Valve Company: Model EBF-650.
4. Zurn Industries, Inc.

D. Sensor Operated Faucet: Cast brass, chrome plated, deck mounted with sensor located on neck of spout.

1. Spout Style: Standard.
2. Power Supply: Battery, easily replaceable, alkaline or lithium, minimum 200,000 cycles.
3. Mixing Valve: External lever operated.
4. Water Supply: 3/8 inch compression connections.
5. Aerator: Vandal resistant, 0.5 GPM, laminar flow device.
6. Sensor range: Factory set at a minimum of 3 inch adjustable up to 24 inch.
7. Finish: Polished chrome.

E. Accessories:

1. Chrome plated 17 gage, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Carrier:
  - a. Manufacturers:
    - 1) MIFAB.
    - 2) J. R. Smith.
    - 3) Watts.

- 4) JOSAM Company.
- 5) Zurn Industries, Inc.
- b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

#### **2.04 SINK (SK-1), ADAAG COMPLIANT**

##### **A. Manufacturers:**

1. Elkay, Inc; Model LRAD-1918-60-3
2. Just
3. Substitutions: See Section 01 60 00 - Product Requirements.

##### **B. Single Compartment Bowl:**

1. ASME A112.19.3; 19 x 18 x 6 inch outside dimensions 18 gage thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
  - a. Drain: 3-1/2 inch basket strainer with brass bucket and tailpiece.

##### **C. Supply Faucet:**

1. Manufacturers:
  - a. T & S Brass and Bronze Works, Inc.
  - b. Chicago Faucet; Model 1100-GN8AE3-317AB.
  - c. Zurn, Industries, Inc.
2. ASME A112.18.1; chrome plated brass supply with 8 inch swing spout, water economy aerator with maximum 2.2 gpm flow, indexed 4" wrist blade handles .

##### **D. Accessories:**

1. Chrome plated 17 gage brass P-trap and arm with escutcheon.
2. Screwdriver stops.
  - a. Manufacturers:
    - 1) Mc Quire Model H2167CC.
    - 2) Brasscraft.
3. Rigid supplies.

#### **2.05 SINK (SK-2)**

##### **A. Manufacturers:**

1. Elkay, Inc; Model LR-1918
2. Just
3. Substitutions: See Section 01 60 00 - Product Requirements.

##### **B. Single Compartment Bowl:**

1. ASME A112.19.3; 19 x 18 x 8 inch outside dimensions 18 gage thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
  - a. Drain: 3-1/2 inch basket strainer with brass bucket and tailpiece.

##### **C. Supply Faucet:**

1. Manufacturers:
  - a. T & S Brass and Bronze Works, Inc.
  - b. Chicago Faucet; Model 1100-GN8AE3-317AB.
  - c. Zurn, Industries, Inc.

2. ASME A112.18.1; chrome plated brass supply with 8 inch swing spout, water economy aerator with maximum 2.2 gpm flow, indexed 4" wrist blade handles .

D. Accessories:

1. Chrome plated 17 gage brass P-trap and arm with escutcheon.
2. Screwdriver stops.
  - a. Manufacturers:
    - 1) Mc Quire Model H2167CC.
    - 2) Brasscraft.
3. Rigid supplies.

**2.06 SINK (SK-3)**

A. Laboratory Basin:

1. Provided under Division 12.

B. Trim:

1. Faucet provided under Division 12.
2. Cold water and hot water.

C. Accessories:

1. Acid waste piping P-trap and arm with escutcheon.
2. Mc Guire-H2167CC Screwdriver stops.
3. Rigid supplies.

**2.07 SINK (SK-4)**

A. Laboratory Basin:

1. Provided under Division 12.

B. Trim:

1. Faucet provided under Division 12.
2. Cold water, hot water and DI water.

C. Accessories:

1. Acid waste piping P-trap and arm with escutcheon.
2. Mc Guire-H2167CC Screwdriver stops.
3. Rigid supplies.

**2.08 SINK (SK-5)**

A. Stainless Steel Double Basin:

1. Provided under Division 12.

B. Trim:

1. Faucet provided under Division 12.
2. Cold water, hot water and DI water.

C. Accessories:

1. Acid waste piping P-trap and arm with escutcheon.
2. Mc Guire-H2167CC Screwdriver stops.
3. Rigid supplies.

## **2.09 SINK (CS-1)**

- A. Fume Hood Cup Sink:
  - 1. Provided under Division 11.
- B. Trim:
  - 1. Faucet provided under Division 11.
  - 2. Cold water only.
- C. Accessories:
  - 1. Acid waste piping P-trap and arm with escutcheon.
  - 2. Mc Guire-H2167CC Screwdriver stops.
  - 3. Rigid supplies.

## **2.10 MOP BASIN (MB-1)**

- A. Manufacturers:
  - 1. Fiat.
  - 2. Mustee; Model 63M.
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Bowl:
  - 1. 24 x 24 x 10 inch high white molded stone, floor mounted, with one inch wide shoulders, and stainless steel strainer.
- C. Supply Faucet:
  - 1. Manufacturers:
    - a. T & S Brass and Bronze Works, Inc.
    - b. Chicago Faucet; Model 897-CP.
    - c. Zurn, Industries, Inc.
  - 2. ASME A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- D. Accessories:
  - 1. Vinyl bumper guards.
  - 2. Stainless steel wall guards.

## **2.11 EMERGENCY SAFETY STATION (ES-1)**

- A. Manufacturers:
  - 1. Haws Corporation
  - 2. Guardian; Model GBF-2150
  - 3. Bradley.
- B. ANSI Z358.1; fully recessed, stainless steel, emergency safety station with pull down eye wash and shower activation lever and stay-open, full flow brass ball valves and 1-1/2 inch brass drain tailpiece and p-trap. Shower includes deluge shower head, eyewash includes steam control and filter. Provide with ANSI compliant identification sign.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

### **3.02 PREPARATION**

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

### **3.03 INSTALLATION**

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall carriers and bolts.

### **3.04 INTERFACE WITH WORK OF OTHER SECTIONS**

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

### **3.05 ADJUSTING**

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

### **3.06 CLEANING**

- A. Clean plumbing fixtures and equipment.

### **3.07 PROTECTION**

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 22 66 00  
PROCESS PIPING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Acid waste piping system.
  - 2. Acid resistant floor drain and cleanouts.
  
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete.
  - 2. Section 11 53 00 - Laboratory Equipment.
  - 3. Section 12 36 00 - Countertops.
  - 4. Section 31 23 16 - Excavation.
  - 5. Section 31 23 23 - Fill.

**1.02 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures:
  - 1. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
  - 2. Provide manufacturer's Installation Instructions.
  
- B. Submit Under Provisions of Section 01 78 00 - Closeout Submittals:
  - 1. Record actual locations of piping, equipment, cleanouts, etc.
  - 2. Operation and Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

**1.03 REFERENCES**

- A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

**1.04 DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store, protect and handle products to site.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

**1.05 PROJECT/SITE CONDITIONS**

- A. Do not install underground piping when bedding are wet or frozen.
- B. Verify that field measurements are in accordance with the manufacturer recommendations.
- C. Field verify routing of existing underslab waste, water, and storm piping.

## **PART 2 PRODUCTS**

### **2.01 ACID WASTE PIPING AND VENT PIPING ABOVE GRADE**

- A. Polypropylene Pipe: Schedule 40, ASTM D2447-74, ATSM D4101
  - 1. Manufacturer:
    - a. Orion Blueline.
    - b. Enfield.
    - c. Zurn.
  - 2. Fittings: Fire retardant polypropylene Schedule 40, ASTM D3311, ASTM D4101
  - 3. Joints:
    - a. Mechanical: 300 Series stainless steel bolt and nut compression coupling system.
    - b. Fusion: hermetically sealed with heat tool and meets ASTM D2657.
  
- B. Chlorinated Polyvinyl Chloride Pipe: CPVC Type IV, minimum ASTM Cell Classification 23447, manufactured in accordance with ASTM F2618 and certified by NSF International for use in corrosive waste drainage systems. Pipe shall be marked with a yellow strip.
  - 1. Manufacturer: Spears Manufacturing Company: LabWaste.
  - 2. Fittings: CPVC, ASTM D3311.
  - 3. Joints: Solvent cement welding, ASTM 2618 and F493.

### **2.02 ACID WASTE PIPING AND VENT PIPING BELOW GRADE**

- A. Polypropylene Pipe: Schedule 40, ASTM D2447-74, ATSM D4101
  - 1. Manufacturer:
    - a. Orion Blueline.
    - b. Enfield.
    - c. Zurn.
  - 2. Fittings: Fire retardant polypropylene Schedule 40, ASTM D3311, ASTM D4101
  - 3. Joints:
    - a. Mechanical: 300 Series stainless steel bolt and nut compression coupling system.
    - b. Fusion: hermetically sealed with heat tool and meets ASTM D2657.
  
- B. Chlorinated Polyvinyl Chloride Pipe: CPVC Type IV, minimum ASTM Cell Classification 23447, manufactured in accordance with ASTM F2618 and certified by NSF International for use in corrosive waste drainage systems. Pipe shall be marked with a yellow strip.
  - 1. Manufacturer: Spears Manufacturing Company: LabWaste.
  - 2. Fittings: CPVC, ASTM D3311.
  - 3. Joints: Solvent cement welding, ASTM 2618 and F493.

### **2.03 ACID RESISTANT FLOOR DRAIN (AWFD-1)**

- A. Manufacturer:
  - 1. Orion AWFDSTD.
  - 2. Zurn.
  - 3. Spears Manufacturing Co. LabWaste.

- B. Fire retardant polypropylene conforming to ASTM D4101. Grate, plug, and covers are to be made with fiber-filled polypropylene for strength and durability. Provide with flashing clamp and vandal proofing.
- C. Chlorinated polyvinyl chloride conforming to ASTM F2618. Grate, plug and covers are to be made with CPVC.

#### **2.04 ACID RESISTANT CLEANOUTS (AFCO)**

- A. Manufacturer:
  - 1. Orion FCO.
  - 2. Zurn.
  - 3. Spears Manufacturing Co. LabWaste.
- B. Fire retardant polypropylene conforming to ASTM D4101. Ferrule with counter-sunk plug and adjustable top with round nickel bronze cover. Provide cover with AAWCO@ cast in cover.
- C. Chlorinated polyvinyl chloride conforming to ASTM F2618. CPVC ferrule with counter-sunk plug and adjustable top with stainless steel cover.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify excavations under provisions of Section 31 23 16 - Excavation.
- B. Verify that excavations are to required grade, dry, and not over-excavated.

#### **3.02 PREPARATION**

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install components level and plumb.
- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Excavate in accordance with Section 02315 for Work of this Section.
- H. Backfill in accordance with Section 02315 for Work of this Section.



### **3.04 ERECTION TOLERANCES**

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot unless otherwise noted on the drawings. Maintain gradients.

### **3.05 INTERFACE WITH OTHER PRODUCTS**

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

**END OF SECTION**

**SECTION 23 05 53**  
**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

**1.02 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Project Record Documents: Record actual locations of tagged valves.

**PART 2 PRODUCTS**

**2.01 IDENTIFICATION APPLICATIONS**

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Automatic Controls: Tags. Key to control schematic.
- D. Control Panels: Nameplates.
- E. Piping: Pipe markers.
- F. Thermostats: Nameplates.
- G. Valves: Tags.

**2.02 NAMEPLATES**

- A. Manufacturers:
  - 1. Kolbi Pipe Marker Co..
  - 2. Seton Identification Products.
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.
  - 4. Letter Color: Black.
  - 5. Letter Height: 1/4 inch.
  - 6. Background Color: Yellow.
  - 7. Plastic: Conform to ASTM D709.

## **2.03 TAGS**

- A. Manufacturers:
  - 1. Brady Corporation.
  - 2. Kolbi Pipe Marker Co..
  - 3. Seton Identification Products.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

## **2.04 PIPE MARKERS**

- A. Manufacturers:
  - 1. Brady Corporation.
  - 2. Kolbi Pipe Marker Co..
  - 3. Seton Identification Products.
- B. Color: Conform to ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

### **3.02 INSTALLATION**

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Use tags on piping 3/4 inch diameter and smaller.
- F. Identify pipe service, flow direction, and pressure.
- G. Install pipe markers in clear view and align with axis of piping.

H. Location of pipe identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

**END OF SECTION**

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic systems.
- C. Measurement of final operating condition of HVAC systems.

**1.02 REFERENCE STANDARDS**

- A. AABC MN-1 - AABC National Standards for Total System Balance; 2002.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
  - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
  - 6. Include the following on the title page of each report:
    - a. Name of Testing, Adjusting, and Balancing Agency.
    - b. Telephone number of Testing, Adjusting, and Balancing Agency.
    - c. Project name.
    - d. Project location.
    - e. Project Architect/Engineer.
    - f. Project Contractor.
    - g. Report date.

E. Project Record Documents: Record actual locations of balancing valves and rough setting.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC MN-1, 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. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  - 2. Having minimum of three years documented experience.
  - 3. Certified by one of the following:
    - a. AABC, Associated Air Balance Council: [www.aabchq.com](http://www.aabchq.com); upon completion submit AABC National Performance Guaranty.
    - b. NEBB, National Environmental Balancing Bureau: [www.nebb.org](http://www.nebb.org).
    - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: [www.tabbcertified.org](http://www.tabbcertified.org).
- E. TAB Supervisor Qualifications: Certified by same organization as TAB agency.

### **3.02 EXAMINATION**

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - 5. Duct systems are clean of debris.
  - 6. Fans are rotating correctly.
  - 7. Air coil fins are cleaned and combed.
  - 8. Access doors are closed and duct end caps are in place.
  - 9. Air outlets are installed and connected.
  - 10. Duct system leakage is minimized.
  - 11. Hydronic systems are flushed, filled, and vented.

- 12. Pumps are rotating correctly.
- 13. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

### **3.03 ADJUSTMENT TOLERANCES**

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

### **3.04 RECORDING AND ADJUSTING**

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. 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.

### **3.05 AIR SYSTEM PROCEDURE**

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

- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions.
- L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

### **3.06 WATER SYSTEM PROCEDURE**

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

### **3.07 SCOPE**

- A. Test, adjust, and balance the following:
  - 1. Packaged Roof Top Heating/Cooling Units.
  - 2. Terminal Heat Transfer Units.
  - 3. Fans.
  - 4. Air Filters.
  - 5. Air Terminal Units.
  - 6. Air Inlets and Outlets.
  - 7. Laboratory Airflow Control System.

**END OF SECTION**



**SECTION 23 07 13  
DUCT INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Duct insulation.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

**1.05 QUALITY ASSURANCE**

- A. 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, with minimum three years of experience and approved by manufacturer.

**1.06 DELIVERY, STORAGE, AND HANDLING**

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

**1.07 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**

### **2.01 REGULATORY REQUIREMENTS**

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

### **2.02 GLASS FIBER, FLEXIBLE**

- A. Manufacturers:
  - 1. Knauf Fiber Glass.
  - 2. Johns Manville Corporation.
  - 3. Owens Corning Corp.
  - 4. CertainTeed Corporation.
- B. Vapor Barrier Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  - 2. Moisture Vapor Permeability: 0.04 perm inch, when tested in accordance with ASTM E96/E96M.
  - 3. Secure with pressure sensitive tape.
- C. Vapor Barrier Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- D. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated ducts conveying air below ambient temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. 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.
- D. Insulated ducts conveying air above ambient temperature:
  - 1. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. 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.

### **3.03 SCHEDULES**

- A. Exhaust Ducts Within 10 ft of Exterior Openings:
  1. Flexible Glass Fiber Duct Insulation: 2 inches thick.
- B. Supply Ducts:
  1. Flexible Glass Fiber Duct Insulation: 2 inches thick.
- C. Return Ducts:
  1. Flexible Glass Fiber Duct Insulation: 2 inches thick.

**END OF SECTION**

**SECTION 23 07 19  
HVAC PIPING INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Piping insulation.
- B. Jackets and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

**1.03 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products 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 with minimum three years of experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

**1.07 FIELD CONDITIONS**

- A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

## **PART 2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

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

### **2.02 GLASS FIBER**

A. Manufacturers:

1. CertainTeed Corporation.
2. Johns Manville Corporation.
3. Knauf Insulation.
4. Owens Corning Corporation.

B. Insulation: ASTM C547; rigid molded, noncombustible.

1. 'K' Value: ASTM C177, 0.23 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

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

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

### **2.03 JACKETS**

A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
  - a. Minimum Service Temperature: 0 degrees F.
  - b. Maximum Service Temperature: 150 degrees F.
  - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
  - d. Thickness: 10 mil.
  - e. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

### **3.02 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

- D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. 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.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. 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.
- I. Inserts and Shields:
  - 1. Application: Piping 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 3. Insert location: Between support shield and piping and under the finish jacket.
  - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

### **3.03 SCHEDULE**

- A. Heating Systems:
  - 1. Heating Water Supply and Return:
    - a. Glass Fiber Insulation:
      - 1) Pipe Size Range: All sizes.
        - a) Thickness: 1-1/2 inch
      - 2) Runouts not over 12 feet in length.
        - a) Thickness: 1 inch.

**END OF SECTION**

**SECTION 23 09 13**  
**INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Thermostats.
- B. Control valves.
- C. Damper operators.
- D. Air flow measuring station.
- E. Miscellaneous accessories.
- F. Rough-in, wiring to, and final connections to products specified in this Section.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 09 23 - Direct-Digital Control System for HVAC.
- B. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gauge taps.
- C. Section 26 27 26 - Wiring Devices: Elevation of exposed components.
- D. Section 26 05 35 - Raceways and Boxes: Requirements for conduit rough-in for products specified in this Section.

**1.03 REFERENCE STANDARDS**

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
  - 1. Revise shop drawings to reflect actual installation and operating sequences.
- E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

- F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

## **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT - GENERAL**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

### **2.02 CONTROL PANELS**

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- B. NEMA 250, general purpose utility enclosures with enamelled finished face panel.
- C. Provide common keying for all panels.

### **2.03 CONTROL VALVES**

- A. Manufacturers.
  - 1. Belimo.
  - 2. Substitutions: See Section 01600 - Product Requirements.
- B. Pressure independent Characterized Control Valve:
  - 1. Valve bodies shall be two-way normally open or closed. Valve bodies 2 inches and smaller shall be bronze, screwed type and shall be rated at 250 psig. Valve bodies 2-1/2 inches and larger shall be iron, flanged and rated at 125 psig except where otherwise noted.
  - 2. Valves shall have stainless steel stems and allow for servicing including packing, stem, and disk replacement.
  - 3. The modulating control valves shall be pressure independent.
    - a. The flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range.
    - b. The control valves shall accurately control the flow from 0 to 100% full rated flow. The valve shall have an equal percentage characteristic.
    - c. For valve sizes 1/2" to 1-1/4", a minimum of 3 psig shall be required to operate the valve pressure independently.
    - d. For valve sizes 1-1/2" to 2", a minimum of 7 psig shall be required to operate the valve pressure independently.
    - e. Valves shall require no maintenance and shall not include replaceable cartridges.
    - f. The valve actuator shall be directly coupled to the valve at the factory.



- g. The valve actuator shall modulate the control valve for 0 to 100% design flow while rotating a maximum of 90 degrees.
- h. Multi-turn actuators are NOT acceptable.
- i. Running time shall be 95 seconds independent of flow setting.
- j. Valve acutator shall be Multi Function Technology as manufactured by Belimo.

C. Electronic Operators:

- 1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
- 2. Select operator for full shut off at maximum pump differential pressure.

## 2.04 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

- 1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
- 2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:

- 1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

## 2.05 INPUT/OUTPUT SENSORS

A. Temperature Sensors:

- 1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
- 2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
- 3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
- 4. Temperature sensing device must be compatible with project DDC controllers.

5. Performance Characteristics:

a. RTD:

- 1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
- 2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
- 3) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
- 4) Range: Minus 40 degrees F through 220 degrees F minimum.

b. Thermistor:

- 1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
- 2) Range: Minus 25 degrees F through 122 degrees F minimum.
- 3) Heat Dissipation Constant: 2.7 mW per degree C.

c. Temperature Transmitter:

- 1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
- 2) Output: 4 - 20 mA.

d. Sensing Range:

- 1) Provide limited range sensors if required to sense the range expected for a respective point.

- 2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.
  - 3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.
  - e. Wire Resistance:
    - 1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
    - 2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.
  - f. Room Temperature Sensors:
    - 1) Match existing Delta stats installed in building.
  - g. Temperature Averaging Elements:
    - 1) Use on duct sensors for ductwork 10 sq ft or larger.
  - h. Insertion Elements:
    - 1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.
    - 2) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.
- B. Humidity Sensors:
- 1. Wall Mounted Sensor: Voltage type encased in a plastic housing.
    - a. Input Power, Voltage Type: Class 2; 12-24 VDC/24 VAC.
    - b. Input Power, mA Type: Class 2; Loop powered 12-30 VDC, 30 mA observed polarity.
    - c. Output Voltage type: 0-10 V.
    - d. Output mA type: 24-20 mA, 2-wire, not polarity sensitive.
  - e. Humidity:
    - 1) HS Element: Digitally profiled thin-film capacitive.
    - 2) Accuracy 2 percent at 10 to 80 percent relative humidity at 77 degrees F.
      - a) Plus/minus 1 percent at 20-40 percent RH in mA output mode; (multi-point calibration, NIST traceable).
    - 3) Scaling: 0-100 percent RH.
  - f. Hysteresis: 1.5 percent typical.
  - g. Linearity: Included in accuracy specification.
  - h. Reset Rate: 24 hours.
  - i. Stability: Plus/minus 1 percent @ 68 degrees F (20 degrees C) annually, for two years.
- C. Static Pressure (Air Pressure) Sensors:
- 1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
  - 2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
  - 3. Accuracy: One percent of full scale with repeatability 0.3 percent.
  - 4. Output: 0 - 5 vdc with power at 12 to 28 vdc.
- D. Equipment Operation Sensors:
- 1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
  - 2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.

3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- E. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.
- F. Carbon Dioxide Sensors, Wall:
1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
    - a. Linear, CO2 Concentration Range Display: 0 to 2000 / 5000 ppm, programmable.
    - b. Accuracy: Plus/minus 30 ppm or plus/minus 2 percent of measured value, measured at NTP.
    - c. Repeatability: Plus/minus 20 ppm or plus/minus 2 percent of measured value.
    - d. Response Time: Less than 60 seconds for 90 percent step change.
    - e. Output:
    - f. Analog: 4-20 mA.
    - g. Communication Protocol: Modbus or BACnet.
      - 1) Connection: 2-wire, RS-485.
      - 2) Data Rate: 9600 bps.
      - 3) Parity: None.
  2. Calibration Characteristics:
    - a. Automatically compensating algorithm for sensor drift due to sensor degradation.
    - b. Maximum Drift: 2 percent.
    - c. User calibratable with a minimum calibration interval of 5 years.
  3. Construction:
    - a. Sensor Chamber: Non-corrosive material for neutral effect on carbon dioxide sample.

## 2.06 TRANSMITTERS

- A. Building Static Pressure Transmitter:
1. One pipe, differential type with temperature compensation, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.
- B. Pressure Transmitters:
1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.
- C. Air Pressure Transmitters:
1. General: Provide dry media differential pressure transducers to monitor duct, room, and \_\_\_\_\_ pressure.
    - a. Media Compatibility: Dry air.
    - b. Input Power: Class 2; 12-30 VDC; 2 - wire: 20 mA max.
    - c. Output: Field selectable, 2-wire, loop-powered 4-20 mA (DC only, clipped & capped).
    - d. Pressure Ranges: 4 and 7, field selectable.
    - e. Response Time:
      - 1) Fast: T95 in 2 seconds.
      - 2) Switch selectable.

f. Mode: Switch selectable, unidirectional.

D. Temperature Transmitters:

1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degree F span and plus or minus 1 percent for 50 degree F span, with 50 degrees F. temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

E. Humidity Transmitters:

1. One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

## 2.07 LOW COIL INPUT RELAYS

A. Manufacturers

1. Functional Devices, Inc.; RIB.

B. Enclosed relay Hi/Low separation 20 amp DPDT +Override.

C. UL Listed, UL916, UL864, C-UL and UL Accepted for use in Plenum, NEMA 1.

D. Power input: 120 Vac, 50-60 Hz or 208-277 Vac, 50-60 Hz as applicable.

E. Control Input: 5-25 Vac/dc, 50-60 Hz.

F. Relay status: LED on = activated.

## 2.08 AIR FLOW MEASURING STATION

A. Manufacturers:

1. Ebtron, Inc.; Model Advantage II Gold Series.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thermal dispersion airflow measurement device. Measuring device shall consist of one or more multi-point measuring probes and a single microprocessor-based transmitter. Transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to be displayed as a velocity or volumetric rate.

C. Transmitter shall be operate on 24 VAC.

D. Transmitter shall be capable of communicating with building automation system using one of the following interface options:

1. Linear analog output signal: Field selectable, fuse protected and isolated, 0-10 VDC and 4-20 mA (4-wire).
2. RS-485: Field selectable ModBus.
3. 10 Base-T Ethernet: Field selectable ModBus TCP and TCP/IP.
4. LonWorks Free Topology.

E. Sensors shall be fabricated of anodized aluminum alloy tube with 303/304 stainless steel mounting brackets.

F. Airflow/temperature measuring devices shall be UL listed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 27 26.
- C. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- D. Provide guards on thermostats in entrances.
- E. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- F. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- G. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- H. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
  - 1. Provide conduit and back boxes for products specified in this Section in accordance with the requirements of Sections 26 05 35.
  - 2. Surface raceways are not permitted. Coordinate rough-ins at time of wall erection.
  - 3. Provide electrical wiring and final connections to products specified in this Section in accordance with the requirements of Section 26 06 20.26.
  - 4. Provide conduit for all control wiring exposed to view. This includes but is not limited to all storage rooms, mechanical rooms, and similar spaces.
  - 5. Provide conduit for all control wiring concealed in inaccessible spaces. This includes but is not limited to wiring above/behind drywall and plaster ("hard") ceilings or soffits, and wiring within vertical chase spaces, regardless of whether access doors are provided or not.
  - 6. Control wiring that is concealed above readily accesible ceilings such as acoustical lay-in ceilings, need not be run in conduit.

**END OF SECTION**

**SECTION 23 09 23  
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. System description.
- B. Operator interface.
- C. Controllers.
- D. Power supplies and line filtering.
- E. System software.
- F. Controller software.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

**1.03 REFERENCE STANDARDS**

- A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; Revision G, 2014.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Expand building control system to interface with new equipment and perform the sequence of operation specified. Modify automation system graphics to delete removed equipment and add new equipment.
- B. Provide a color graphical representation of all systems. The graphical display shall include all points indicated in the pints list and any others required to achieve the sequences of operation. The graphical user interface shall consist of the following as a minimum;
  - 1. Menu bar navigation via windows-like bars.
  - 2. Navigation will also be available via an image of the building profile from which the user clicks on floors to bring up individual floor plans.
  - 3. The individual floor plan zones shall change color based upon the difference between the actual zone temperature and zone set point so that the operator can tell at a glance if zones are in, above or below acceptable ranges. A minimum of five (5) colors are required: Color 1 = within acceptable range of set point, Color 2 = warning - zone is above acceptable range of set point and approaching high temperature alarm; Color 3 = zone is in high temperature alarm; Color 4 = warning - zone is below acceptable range of set point and approaching low temperature alarm; Color 5 = zone is in low temperature alarm.
  - 4. Clicking on a floor plan zone shall bring up a dynamic color graphic of the mechanical equipment that serves that zone.

5. Each major piece of mechanical equipment (terminal unit, AHU, boiler, chillers, cooling towers, etc.) shall have a pictorial dynamic color graphic. The central plant equipment may be combined as appropriate on one or more graphic page.
6. Text-based (non-pictorial) summary screens will also be provided so that the operator may view critical information on multiple units at once. Summary screens will be provided for terminal units and air handling units. Summary screens for VAV/FPVAV boxes will contain as a minimum room temperature, room temperature set point, occ/unocc status and CFM for each box. Summary screens for AHUs will contain as a minimum space temperature (CV units) or discharge temperature (VAV units) and the corresponding set point, static pressure (VAV units), OA damper position, mixed air temperature, fan status and occ/unocc status.
7. Clicking on a unit on any summary screen shall bring up the complete graphic for that unit.
8. Outside air temperature shall be displayed on each graphic screen.

## **1.05 SUBMITTALS**

- A. Product Data: Provide data for each system component and software module.
- B. Shop Drawings:
  1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
  2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.
  3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
  4. Indicate description and sequence of operation of operating, user, and application software.
- C. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
  1. Revise shop drawings to reflect actual installation and operating sequences.
- D. Operation and Maintenance Data:
  1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
  2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
  3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

## **1.06 PROTECTION OF SOFTWARE RIGHTS**

- A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
  1. Limiting use of software to equipment provided under these specifications.
  2. Limiting copying.
  3. Preserving confidentiality.
  4. Prohibiting transfer to a third party.
- B. Provide Owner administrative rights after warranty period expires.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Delta Controls Chicago, 630-589-3800.

### **2.02 SYSTEM DESCRIPTION**

- A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
- B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- E. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

### **2.03 OPERATOR INTERFACE**

- A. Existing to remain.

### **2.04 CONTROLLERS**

#### **A. BUILDING CONTROLLERS**

- 1. General:
  - a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
  - b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
  - c. Share data between networked controllers.
  - d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
  - e. Utilize real-time clock for scheduling.
  - f. Continuously check processor status and memory circuits for abnormal operation.
  - g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
  - h. Communication with other network devices to be based on assigned protocol.
- 2. Communication:
  - a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
  - b. Perform routing when connected to a network of custom application and application specific controllers.



- c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
  - 3. Anticipated Environmental Ambient Conditions:
    - a. Conditioned Space:
      - 1) Mount within dustproof enclosures.
      - 2) Rated for operation at 32 to 120 degrees F.
  - 4. Provisions for Serviceability:
    - a. Diagnostic LEDs for power, communication, and processor.
    - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
  - 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
  - 6. Power and Noise Immunity:
    - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    - b. Perform orderly shutdown below 80 percent of nominal voltage.
    - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.
- B. INPUT/OUTPUT INTERFACE
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
  2. All Input/Output Points:
    - a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
    - b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
  3. Binary Inputs:
    - a. Allow monitoring of On/Off signals from remote devices.
    - b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
    - c. Sense dry contact closure with power provided only by the controller.
  4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.
  5. Analog Inputs:
    - a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
    - b. Compatible with and field configurable to commonly available sensing devices.
  6. Binary Outputs:
    - a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
    - b. Outputs provided with three position (On/Off/Auto) override switches.
    - c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
  7. Analog Outputs:
    - a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.

- b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
  - c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
- a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
  - b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
  - c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
- a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
  - b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

## **2.05 POWER SUPPLIES AND LINE FILTERING**

### **A. Power Supplies:**

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

### **B. Power Line Filtering:**

1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:
  - a. Dielectric strength of 1000 volts minimum.
  - b. Response time of 10 nanoseconds or less.
  - c. Transverse mode noise attenuation of 65 dB or greater.
  - d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

## **2.06 LOCAL AREA NETWORK (LAN)**

- A. Provide communication between control units over local area network (LAN) matching existing system.

## 2.07 CONTROLLER SOFTWARE

- A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.
- B. System Security:
  - 1. User access secured via user passwords and user names.
  - 2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
  - 3. User Log On/Log Off attempts are recorded.
  - 4. Automatic Log Off occurs following the last keystroke after a user defined delay time.
- C. Object or Object Group Scheduling:
  - 1. Weekly Schedules Based on Separate, Daily Schedules:
    - a. Include start, stop, optimal stop, and night economizer.
    - b. 10 events maximum per schedule.
    - c. Start/stop times adjustable for each group object.
- D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.
- E. Alarms:
  - 1. Binary object is set to alarm based on the operator specified state.
  - 2. Analog object to have high/low alarm limits.
  - 3. All alarming is capable of being automatically and manually disabled.
  - 4. Alarm Reporting:
    - a. Operator determines action to be taken for alarm event.
    - b. Alarms to be routed to appropriate workstation.
    - c. Reporting Options:
- F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.
- G. Sequencing: Application software based upon specified sequences of operation shown on the Drawings.
- H. PID Control Characteristics:
  - 1. Direct or reverse action.
  - 2. Anti-windup.
  - 3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
  - 4. User selectable controlled variable, set-point, and PED gains.
- I. Staggered Start Application:
  - 1. Prevents all controlled equipment from simultaneously restarting after power outage.
  - 2. Order of equipment startup is user selectable.
- J. On-Off Control with Differential:
  - 1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
  - 2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

K. Run-Time Totalization:

1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

## **2.08 HVAC CONTROL PROGRAMS**

A. General:

1. Support Inch-pounds and SI (metric) units of measurement.
2. Identify each HVAC Control system.

B. Optimal Run Time:

1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

### **3.02 INSTALLATION**

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units. Implement all features of programs to specified requirements and appropriate to sequence of operation.
- C. Provide conduit and electrical wiring in accordance with Section 26 06 20.26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
  1. Provide conduit for all control wiring exposed to view. This includes but is not limited to all storage rooms, mechanical rooms, and similar spaces.
  2. Provide conduit for all control wiring concealed in inaccessible spaces. This includes but is not limited to wiring above/behind drywall and plaster ("hard") ceilings or soffits, and wiring within vertical chase spaces, regardless of whether access doors are provided or not.
  3. Control wiring that is concealed above readily accesible ceilings such as acoustical lay-in ceilings, need not be run in conduit.
- D. All exposed conduit wiring that is not located above an accessible ceiling shall be installed in conduit. This includes all storage room, mechanical rooms, etc.

### **3.03 MANUFACTURER'S FIELD SERVICES**

- A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
- B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 1 day period.
- C. Provide basic operator training for 3 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 8 hours dedicated instructor time. Provide training on site.

### **3.04 DEMONSTRATION AND INSTRUCTIONS**

- A. Demonstrate complete and operating system to Owner.

**END OF SECTION**

**SECTION 23 09 26**  
**LABORATORY AIRFLOW CONTROL SYSTEM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Laboratory airflow control system.

**1.02 RELATED SECTIONS**

- A. Section 23 09 23 - Direct-Digital Control System for HVAC.
- B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
- C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.03 REFERENCES**

- A. ANSI - American National Standards Institute.
- B. NEMA - National Electrical Manufacturers Association.
- C. UL - Underwriters Laboratories.
- D. CSA - Canadian Standards Association.

**1.04 SYSTEM DESCRIPTION**

- A. A laboratory airflow control system shall be provided to control the airflow into and out of laboratory rooms. The exhaust flow rate of a laboratory fume hood shall be controlled precisely to maintain a constant average face velocity into the fume hood at either a standard/in-use or standby level based on an operator's presence in front of the fume hood. The laboratory control system shall vary the amount of make-up/supply air into the room to operate the laboratories at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates and maintain laboratory pressurization in relation to adjacent spaces (positive or negative). The laboratory airflow control system shall be capable of operating as a standalone system or as a system integrated with the Building Management System (BMS).

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Description of system operation.
- C. Electrical power and control wiring diagram.
- D. Control layout drawing with sequence of operation.
- E. Operation and maintenance manuals including:
  - 1. System summary sheet.
  - 2. Description of system operation, with equipment and control sequence of operation.
  - 3. Electrical power and control wiring diagrams.
  - 4. Installation and maintenance manuals from equipment manufacturers.

5. Submittals and operation and maintenance manuals shall be assembled in a neat and orderly manner and bound in booklet form. Include a front page that identifies the job particulars followed by a table of contents.

#### **1.06 QUALITY ASSURANCE**

- A. The laboratory airflow control system supplier shall provide a list of at least three similar laboratory airflow control systems installed in the state as part of this proposal.
- B. The laboratory airflow control system supplier shall provide the names, addresses and telephone numbers of the consulting engineer and the owner's representative for each of these installations. It is understood that these individuals may be contacted regarding timely delivery, the quality of installation, the operation and performance of the equipment and the service requirements for each installation. Unsatisfactory performance or inability to provide references shall be grounds for rejection.
- C. Any alternate laboratory airflow control system supplier shall provide a separate compliance schedule, which shall include the section, paragraph and subparagraph of these specifications, and a direct statement to indicate compliance or noncompliance with the requirements. For all areas of noncompliance, the supplier shall describe what specific and alternative approach or approaches has been taken and document the impact this will have on the sizing of the air delivery systems, the required cooling and heating capacities, energy costs and maintenance of the building.
- D. The alternate laboratory airflow control system supplier shall furnish a letter of compliance to the engineer, signed by a corporate officer of the laboratory system manufacturer, certifying the compliance and noncompliance items as stated above 10 days prior to the bid.

#### **1.07 PERFORMANCE VERIFICATION**

- A. The laboratory airflow control system supplier shall demonstrate a typical laboratory space that includes multiple fume hoods, a general exhaust and a supply airflow control device for the purpose of verifying the laboratory airflow control system's ability to meet the performance requirements indicated in this specification. All travel and lodging costs to witness the performance verification shall be the responsibility of the laboratory airflow control system supplier.

#### **1.08 WARRANTY**

- A. Warranty shall commence upon the date of shipment and extend for a period of 36 months, whereupon any defects in materials or laboratory airflow control system performance shall be repaired by the supplier at no cost to the owner.

#### **1.09 PREVENTIVE MAINTENANCE**

- A. The laboratory airflow control system supplier shall provide at no additional cost to the owner during and after the warranty period five years of required preventive maintenance on all airflow sensors (e.g., pitot tube, flow cross, orifice ring, air bar, hot wire, vortex shedder, side wall sensors, etc.) and flow transducers provided under this section. Airflow sensors shall be removed, inspected, and cleaned annually during the five-year period to prevent inaccuracies due to long-term buildup from corrosion, lab tissues, wet or sticky particles, or other materials that foul the sensor. If impractical to remove the airflow sensors, the laboratory airflow control system supplier

shall include in the proposal the cost of supplying and installing duct access doors, one for each sensor. The transducer shall be checked and recalibrated annually to ensure long-term accuracy. Note that auto-zero recalibration of transducers is not acceptable as a substitute for annual recalibration.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. The plans and specifications for the laboratory airflow control system are based on systems and equipment manufactured by **Phoenix Controls Corporation**.
- B. The laboratory airflow system provider shall be an entity that designs, develops, manufactures and sells products and services to control the environment and airflow of critical spaces using a Quality Management System registered to ISO 9001:2000.
- C. In strict accordance with this specification, alternative laboratory airflow control systems and equipment shall only be considered for approval provided that the equipment be equal in every respect to the operational characteristics, capacities and intent of control sequences specified herein. Approval to bid does not relieve the laboratory airflow control system supplier from complying with the minimum requirements or intent of this specification.
- D. The engineer and owner shall be the sole judges of quality and equivalence of equipment, materials, methods and life cycle cost.
- E. Only those systems specifically named in this specification or by addendum shall be considered for approval. Other systems submitted after the bid opening will be returned without review.

### **2.02 TECHNICAL**

- A. Proposed Equipment
  - 1. The laboratory airflow control system supplier shall provide a detailed proposal describing all elements of the laboratory control system. A schematic laboratory layout shall be provided, showing relations of these elements and a description of how they interact.
  - 2. Technical specification data sheets shall be provided for all proposed system components and devices.
  - 3. All proposed airflow control devices shall include discharge, exhaust and radiated sound power level performance obtained from testing in accordance with ARI Standard 880.

### **2.03 AIRFLOW CONTROL SYSTEM DESCRIPTION**

- A. Each laboratory shall have a dedicated laboratory airflow control system. Each dedicated laboratory airflow control system shall support a minimum of 20 network controlled airflow devices.
- B. The laboratory airflow control system shall employ individual average face velocity controllers that directly measure the area of the fume hood sash opening and proportionally control the hood's exhaust airflow to maintain a constant face velocity over a minimum range of 20% to 100% of sash travel. The corresponding minimum hood exhaust flow turndown ratio shall be 5 to 1.
- C. The hood exhaust airflow control device shall respond to the fume hood sash opening by achieving 90% of its commanded value within one second of the sash reaching 90% of its final



position (with no more than 5% overshoot/undershoot) of required airflow. Rate of sash movement shall be from one to one and one-half feet per second.

- D. The laboratory airflow control system shall maintain specific airflow ( $\pm 5\%$  of signal within one second of a change in duct static pressure) regardless of the magnitude of the pressure change, airflow change or quantity of airflow control devices on the manifold (within 0.6" to 3.0" wc).
- E. The laboratory airflow control system shall use volumetric offset control to maintain room pressurization. The system shall maintain proper room pressurization polarity (negative or positive) regardless of any change in room/system conditions, such as the raising and lowering of any or all fume hood sashes or rapid changes in duct static pressure. Systems using differential pressure measurement or velocity measurement to control room pressurization are unacceptable.
- F. The laboratory airflow control system shall maintain specific airflow ( $\pm 5\%$  of signal) with a minimum 16 to 1 turndown to ensure accurate pressurization at low airflow and guarantee the maximum system diversity and energy efficiency.

#### 2.04 AIRFLOW CONTROL SOUND SPECIFICATION

- A. Unless otherwise specified, the airflow control device shall not exceed the sound power levels in Tables 1, 2 and 3.
- B. If the airflow control device cannot meet the sound power level specification, a properly sized silencer or sound attenuator must be used. All silencers must be of a packless design (constructed of at least 18 gauge 316L stainless steel when used with fume hood exhaust) with a maximum pressure drop at the device's maximum rated flow rate not to exceed 0.20 inches of water.
- C. All proposed airflow control devices shall include discharge, exhaust and radiated sound power level performance.

#### D. Exhaust Airflow Control Device Sound Power Level;

Exhaust Sound Power Level in dB (re: 10-12 watts)

Octave Band Number 234567

Center Frequency in Hz 125 Hz 250 Hz 500 Hz 1000 Hz 2000 Hz 4000 Hz

1000-50 CFM Device

800 CFM @ 0.6" wc 63 55 52 54 50 49

200 CFM @ 0.6" wc 46 42 38 37 32 25

800 CFM @ 3.0" wc 73 70 64 66 65 60

200 CFM @ 3.0" wc 51 52 51 50 52 51

1500-100 CFM Device

1200 CFM @ 0.6" wc 65 58 53 56 52 52

400 CFM @ 0.6" wc 50 45 38 39 37 31

1200 CFM @ 3.0" wc 72 70 62 65 64 60

400 CFM @ 3.0" wc 55 57 55 53 56 55

3000-200 CFM Device

2400 CFM @ 0.6" wc 63 56 55 58 54 55

800 CFM @ 0.6" wc 51 45 41 42 39 34

2400 CFM @ 3.0" wc 75 71 65 68 67 63

800 CFM @ 3.0" wc 58 58 56 56 59 58

E. Supply Airflow Control Device Sound Power Level (Discharge);

Discharge Sound Power Level in dB(re: 10-12 watts)

Octave Band Number 234567

Center Frequency in Hz 125 Hz 250 Hz 500 Hz 1000 Hz 2000 Hz 4000 Hz

1000-50 CFM Device

800 CFM @ 0.6" wc 62 57 54 58 54 51

200 CFM @ 0.6" wc 45 46 42 44 40 34

800 CFM @ 3.0" wc 72 71 67 75 72 68

200 CFM @ 3.0" wc 53 56 54 58 56 54

1500-100 CFM Device

1200 CFM @ 0.6" wc 63 59 55 60 54 53

400 CFM @ 0.6" wc 53 49 44 49 45 39

1200 CFM @ 3.0" wc 72 73 69 77 72 68

400 CFM @ 3.0" wc 58 63 61 63 60 57

3000-200 CFM Device

2400 CFM @ 0.6" wc 64 60 58 63 56 56

800 CFM @ 0.6" wc 52 48 47 52 46 41

2400 CFM @ 3.0" wc 75 75 72 78 73 70

800 CFM @ 3.0" wc 59 62 62 66 62 60

F. Supply Airflow Control Device Sound Power Level (Radiated);

Radiated Sound Power Level in dB (re: 10-12 watts)

Octave Band Number 234567

Center Frequency in Hz 125 Hz 250 Hz 500 Hz 1000 Hz 2000 Hz 4000 Hz

1000-50 CFM Device

800 CFM @ 0.6" wc 44 41 45 41 36 34

200 CFM @ 0.6" wc 33 28 31 29 26 20

800 CFM @ 3.0" wc 53 53 56 57 55 53

200 CFM @ 3.0" wc 41 38 41 39 39 37

1500-100 CFM Device

1200 CFM @ 0.6" wc 47 53 40 42 38 36

400 CFM @ 0.6" wc 35 39 31 34 33 26

1200 CFM @ 3.0" wc 52 60 54 60 59 53

400 CFM @ 3.0" wc 42 44 43 46 46 42

3000-200 CFM Device

2400 CFM @ 0.6" wc 58 56 45 47 43 42

800 CFM @ 0.6" wc 45 43 36 39 37 29

2400 CFM @ 3.0" wc 69 68 60 65 63 57

800 CFM @ 3.0" wc 54 53 48 51 50 48

## 2.05 LABORATORY AIRFLOW CONTROL EQUIPMENT

- A. For variable air volume (VAV) systems, a sash sensor shall be provided to measure the height of each vertically moving fume hood sash. A sash sensor shall also be provided for horizontal overlapping sashes. Control systems employing sidewall mounted velocity sensors shall be unacceptable.
- B. The airflow at the fume hood shall vary in a linear manner between two adjustable minimum and maximum flow set points to maintain a constant face velocity throughout this range. A minimum volume flow shall be set to assure flow through the fume hood even with the sash fully closed.
- C. A fume hood monitor shall be provided to receive the sash sensor output, and presence and/or motion signal. This same monitor shall generate an exhaust airflow control signal for the appropriate airflow control device in order to provide a constant average face velocity. Audible and separate visual alarms shall be provided for flow alarm and emergency exhaust conditions. The fume hood monitor shall incorporate the following capabilities:
  - 1. Alarm Muting option, which silences the audible alarm for an adjustable time period when the mute button is pushed. If another alarm is generated during the mute period, the new alarm will override the mute delay and the alarm will sound again.
  - 2. Auto Alarm Muting option, which sets the alarm to mute automatically after 20 seconds.
  - 3. Emergency Exhaust button with LED, which activates an emergency exhaust mode. In this mode, the exhaust air is at its maximum flow. When activated, the alarm will sound and the LED will flash. To activate emergency exhaust mode, push the button. Push the button again to cancel emergency exhaust mode.

4. Flow Alarm LED, which illuminates to indicate an unsafe airflow condition. The audible alarm will also activate and may be muted.
5. Broken retracting cable alarm, an audible alarm with a flashing LED that indicates whether a vertical sash sensor cable is detached, thereby ensuring the fume hood users' safety.

## **2.06 AIRFLOW CONTROL DEVICE - GENERAL**

- A. The airflow control device shall be a venturi valve.
- B. The valve assembly manufacturer's Quality Management System shall be registered to ISO 9001:2000.
- C. The airflow control device shall be pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifolded system.
- D. The airflow control device shall maintain accuracy within  $\pm 5\%$  of signal over an airflow turndown range of no less than 16 to 1.
- E. No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.
- F. The airflow control device shall be constructed of one of the following three types:
  1. Class A-The airflow control device for non-corrosive airstreams, such as supply and general exhaust, shall be constructed of 16-gauge aluminum. The device's shaft and shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal mounting link shall be made of aluminum. The pressure independent springs shall be a spring-grade stainless steel. All shaft bearing surfaces shall be made of a Teflon, polyester or PPS (polyphenylene sulfide) composite.
    - a. Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction. No sound absorptive materials of any kind shall be used.
  2. Class B-The airflow control device for corrosive airstreams, such as fume hoods and biosafety cabinets, shall have a baked-on, corrosion-resistant phenolic coating. The device's shaft shall be made of 316 stainless steel with a Teflon coating. The shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal mounting link shall be made of 316 or 303 stainless steel. The pressure independent springs shall be a spring-grade stainless steel. The internal nuts, bolts and rivets shall be stainless steel. All shaft bearing surfaces shall be made of a Teflon or PPS (polyphenylene sulfide) composite.
  3. Class C-The airflow control device for highly corrosive airstreams shall be constructed as defined in Class B. In addition, these devices shall have no exposed aluminum or stainless steel components. Shaft support brackets, pivot arm, internal mounting link, and pressure independent springs shall have a baked-on, corrosion-resistant phenolic coating in addition to the materials defined in Class B. The internal nuts, bolts, and rivets shall be titanium or phenolic coated stainless steel. Only devices clearly defined as "high corrosion resistant" on project drawings will require this construction.

G. Actuation

1. For electrically actuated VAV operation, a UL 916 listed electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to fail to last position.
2. Constant volume valves do not require actuators.

H. The controller for the airflow control devices shall be microprocessor based and operate using peer-to-peer control architecture. The room-level airflow control devices shall function as a standalone network.

I. The room-level control network shall utilize a LonTalk communications protocol.

J. There shall be no reliance on external or building-level control devices to perform room-level control functions. Each laboratory control system shall have the capability of performing fume hood control, pressurization control, temperature control, humidity control, and implement occupancy and emergency mode control schemes.

K. The laboratory airflow control systems shall be integrated into the BMS per paragraph "INTERFACE TO BUILDING MANAGEMENT SYSTEMS" below.

L. Certification

1. Each airflow control device shall be factory calibrated to the job specific airflows as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of no more than  $\pm 1\%$  of signal over the entire range of measurement. Electronic airflow control devices shall be further calibrated and their accuracy verified to  $\pm 5\%$  of signal at a minimum of 48 different airflows across the full operating range of the device.
2. Each airflow control devices shall be marked with device-specific factory calibration data. At a minimum, it should include the tag number, serial number, model number, eight-point characterization information (for electronic devices), and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation.
3. Provide NIST Factory Characterization Certificate for each airflow control device (air valve).

M. Airflow control devices that are not venturi valves and airflow measuring devices (e.g., pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) shall only be acceptable, provided these meet all the performance and construction characteristics as stated throughout this specification and:

1. The airflow control device employs transducers manufactured by Rosemount, Bailey, Bristol, or Foxboro. Accuracy shall be no less than  $\pm 0.15\%$  of span (to equal  $\pm 5\%$  of signal with a 15 to one turndown) over the appropriate full-scale range, including the combined effects of nonlinearity, hysteresis, repeatability, drift over a one-year period, and temperature effect. 316L stainless steel materials shall be provided for all exhaust applications. The use of 304 stainless steel materials shall be provided for all make-up air applications.
2. Airflow sensors shall be of a multi-point averaging type, 304 stainless steel for all supply and general exhaust applications, 316L stainless steel for all fume hood, canopy, snorkel, and biosafety cabinet applications. Single point sensors are not acceptable.
3. Suppliers of airflow control devices or airflow measuring devices requiring minimum duct diameters shall provide revised duct layouts showing the required straight duct runs upstream and downstream of these devices. Coordination drawings reflecting these changes shall be submitted by the supplier of the laboratory airflow control system. In addition, suppliers shall include static pressure loss calculations as part of their submittals. All costs to modify the

ductwork, increase fan sizes and horsepower and all associated electrical changes shall be borne by the laboratory airflow control supplier.

## **2.07 EXHAUST AND SUPPLY AIRFLOW DEVICE CONTROLLER**

- A. The airflow control device shall be a microprocessor-based design and shall use closed loop control to linearly regulate airflow based on a digital control signal. The device shall generate a digital feedback signal that represents its airflow.
- B. The airflow control device shall store its control algorithms in non-volatile, re-writeable memory. The device shall be able to stand-alone or to be networked with other room-level digital airflow control devices using an industry standard protocol.
- C. Room-level control functions shall be embedded in and carried out by the airflow device controller using distributed control architecture. Critical control functions shall be implemented locally; no room-level controller shall be required.
- D. The airflow control device shall use industry standard 24 Vac power.
- E. The airflow control device shall have provisions to connect a notebook PC commissioning tool and every node on the network shall be accessible from any point in the system.
- F. The airflow control device shall have built-in integral input/output connections that address fume hood control, temperature control, humidity control occupancy control, emergency control, and non-network sensors switches and control devices. At a minimum, the airflow controller shall have:
  - 1. Three universal inputs capable of accepting 0 to 10 Vdc, 4 to 20 mA, 0 to 65 K ohms, or Type 2 or Type 3 10 K ohm @ 25 degree C thermistor temperature sensors.
  - 2. One digital input capable of accepting a dry contact or logic level signal input.
  - 3. Two analog outputs capable of developing either a 0 to 10 Vdc or 4 to 20 mA linear control signal.
  - 4. One Form C (SPDT) relay output capable of driving up to 1 A @ 24 Vac/Vdc.
- G. The airflow control device shall meet FCC Part 15 Subpart J Class A and be UL916 listed.

## **2.08 LABORATORY OFFICE AIRFLOW CONTROL DEVICE**

- A. The airflow control device shall maintain a temperature set point by controlling the airflow and the reheat valve (if required) in response to a room temperature sensor. An additional output shall be provided for supplementary cooling or heating of the office space. If the office airflow supply device is not required for make-up airflow control for fume hoods, then the one-second speed of response and fail-safe conditions required of the laboratory airflow control system shall not apply.

## **2.09 CONSTANT VOLUME AIRFLOW CONTROL DEVICE**

- A. The airflow control device shall maintain a constant airflow set point. It shall be factory calibrated and set for the desired airflow. It shall also be capable of field adjustment for future changes in desired airflow.
- B. Laboratory airflow control systems suppliers not employing constant volume venturi airflow control valves shall provide pneumatic tubing or electrical wiring as required for their devices.

## 2.10 CONTROL FUNCTIONS

A. The airflow control devices shall utilize peer-to-peer, distributed control architecture to perform room-level control functions. Master-slave control schemes shall not be acceptable. Control functions shall include, at a minimum, pressurization, temperature, humidity control, as well as respond to occupancy and emergency control commands.

### 1. Pressurization Control

- a. The laboratory control system shall control supply and auxiliary exhaust airflow devices in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. This offset shall be field adjustable and represents the volume of air, which will enter (or exit) the room from the corridor or adjacent spaces.
- b. The pressurization control algorithm shall sum the flow values of all supply and exhaust airflow devices and command appropriate controlled devices to new set points to maintain the desired offset. The offset shall be adjustable.
- c. The pressurization control algorithm shall consider both networked devices, as well as:
- d. Up to three non-networked devices providing a linear analog flow signal.
- e. Any number of constant volume devices where the total of supply devices and the total of exhaust devices may be factored into the pressurization control algorithm.
- f. Volumetric offset shall be the only acceptable means of controlling room pressurization. Systems that rely on differential pressure as a means of control shall provide documentation to demonstrate that space pressurization can be maintained if fume hood sashes are changed at the same time a door to the space is opened.
- g. The pressurization control algorithm shall support the ability to regulate the distribution of total supply flow across multiple supply airflow control devices in order to optimize air distribution in the space.

### 2. Temperature Control

- a. The laboratory control system shall regulate the space temperature through a combination of volumetric thermal override and control of reheat coils and/or auxiliary temperature control devices. The laboratory control system shall support up to four separate temperature zones for each pressurization zone. Each zone shall have provisions for monitoring up to five temperature inputs and calculating a straight-line average to be used for control purposes. Separate cooling and heating set points shall be writeable from the BMS, with the option of a local offset adjustment.
- b. Temperature control shall be implemented through the use of independent primary cooling and heating control functions, as well as an auxiliary temperature control function, which may be used for either supplemental cooling or heating. Cooling shall be provided as a function of thermal override of conditioned air with both supply and exhaust airflow devices responding simultaneously so as to maintain the desired offset. Heating shall be provided through modulating control of a properly sized reheat coil.
- c. The laboratory control system shall also provide the built-in capability for being configured for hot deck/cold deck temperature control.
- d. The auxiliary temperature control function shall offer the option of either heating or cooling mode and to operate as either a standalone temperature control loop, or staged to supplement the corresponding primary temperature control loop.

3. Occupancy Control
  - a. The laboratory control system shall have the ability to change the minimum ventilation and/or temperature control set points, based on the occupied state, in order to reduce energy consumption when the space is not occupied. The occupancy state may be set by either the BMS as a scheduled event or through the use of a local occupancy sensor or switch. The laboratory control system shall support a local occupancy override button that allows a user to override the occupancy mode and set the space to occupied for a predetermined interval. The override interval shall be configurable from one to 1440 minutes. The local occupancy sensor/switch or bypass button shall be given priority over a BMS command.
4. Emergency Mode Control
  - a. The laboratory control system shall provide a means of overriding temperature and pressurization control in response to a command indicating an emergency condition exists, and airflow control devices are to be driven to a specific flow set point. The system shall support up to four emergency control modes. The emergency control modes may be initiated either by a local contact input or BMS command.
  - b. Once an emergency mode is invoked, pressurization and temperature control are overridden for the period that the mode is active. Emergency modes shall have a priority scheme allowing a more critical mode to override a previously set condition.
5. Local Alarm Control
  - a. The laboratory control system shall provide the means of summing selective alarm activity at the room-level network and generating a local alarm signal. The local alarm signal may be directed to any available output, as well as to the BMS. The alarm mask may be configured differently for each room-level system.
6. Diversity Alarm
  - a. The laboratory control system shall have the ability of monitoring the airflow values for the pressurized space and generating an alarm signal in the event the total exhaust flow exceeds a predetermined threshold. The diversity alarm is intended to allow the user to take diversity in the design and generate an alarm condition in the event the diversity threshold is compromised. This function must be available in either an integrated or standalone system.
- B. The laboratory control system shall be segregated into subnets to isolate network communications to ensure room-level control functions and BMS communications are carried out reliably. Each laboratory space or pressurization zone shall be its own subnet. Commercially available routers shall be used to provide this isolation.
- C. The laboratory airflow control system shall support at least 20 networked devices in each pressurized zone.
- D. All points shall be available through the interface to the BMS for trending, archiving, graphics, alarm notification and status reports. Laboratory airflow control system performance (speed, stability and accuracy) shall be unaffected by the quantity of points being monitored, processed or controlled.
- E. As a minimum provide the following points to be monitored and adjustable (where indicated) via the BMS interface:
  1. Room Temperature and Setpoint (adj)



2. Occupancy and Setback/Setup of Space Temperatures and Airflow Rate minimums
3. Airflow Rate - Supply, General Exhaust, Fume Hood
4. Hood Alarm and Emergency Purge Mode

## 2.11 INTERFACE TO BUILDING MANAGEMENT SYSTEMS

- A. Laboratory Air Control System (LACS) critical environment integration shall support distributed network architecture with BACnet communication available at the room level via direct connection to the building backbone. Integration must also support the ability to have a single point of access in the case that multiple IP addresses are not acceptable by a customer.
- B. LACS critical environment integration shall support the following protocols: BACnet/IP, BACnet/Ethernet, BACnet/ MS/TP and shall be field upgradable/switchable between any of these protocols.
- C. LACS critical environment integration shall support an optional web-based graphical interface. Graphical interface shall support trending, long term data storage, “gadget based” layout, and should include algorithms to assist in analyzing data for Energy monitoring, fumehood usage, and air change rate monitoring and alarming. The interface must also incorporate an alarm portal that allows a single access point for all alarms in a facility, and must be able to support remote alarming Via Email and or text message.
- D. LACS Building level communication must not under any circumstance disrupt the communication between devices in a room or zone. Communication between devices in a room or zone must be able to operate independent of communication between said room or zone in case the building backbone is brought down for any reason. Communication between room or zone level devices is critical to keep isolated in order to maintain the integrity of the airflow.
- E. LACS critical environment integration shall provide an easy means to access room level device health status at a room-by-room or building wide level via web page.
- F. LACS critical environment integration shall provide an easy means to access a Test and Balance function tool at a room-by-room or building wide level via web page.
- G. LACS critical environment integration must be able to support SQL push for long-term data storage. All room-level points shall be available to the BMS for monitoring or trending as shown in Table 1. The LACS server shall maintain a cache of all points to be monitored by the BMS. The room-level airflow control devices shall update this cache continually. Integration point list shall be:

Point Description	Read/Write
1. Valve-Level (per Valve):	
a. Flow Set Point	Read Only
b. Flow Feedback	Read Only
c. Jam Alarm	Read Only
d. Flow Alarm	Read Only
e. User Definable Inputs/Outputs	Read/Write
f. User Definable Alarm Points	Read Only
2. Zone Balance Control (per Zone):	
a. Occupied Min Ventilation Rate	Read/Write

b. Unoccd Min Ventilation Rate	Read/Write
c. Offset	Read Only
d. Offset Set Point	Read/Write
e. MAV Command & Feedback	Read Only
f. GEX Command & Feedback	Read Only
g. Return Command & Feedback	Read Only
h. Total Zone Supply Flow	Read Only
i. Total Zone Exhaust Flow	Read Only
j. Total Hood Flow Feedback	Read Only
k. Diversity Alarm	Read Only
3. Fume Hood Control (per Hood Valve)	
a. Face Velocity	Read Only
b. Face Velocity Set Point	Read Only
c. Sash Opening Percentage	Read Only
d. User Status	Read Only
e. Hood Override Alarm	Read Only
f. Sash Height Alarm	Read Only
g. Broken Sash Cable Alarm	Read Only
h. Sash Switch Status	Read Only
4. Emergency Mode (per Zone)	
a. Emergency Mode Override	Read/Write
b. Emergency Mode State	Read Only
5. Occupancy Control (per Zone)	
a. Occupancy Override	Read/Write
b. Occupancy State	Read Only
6. Temperature Control (per Zone)	
a. Space Temperature	Read Only
b. Avg Space Temperature	Read Only
c. Discharge Air Temperature	Read Only
d. Duct Temperature	Read Only
e. Temperature Set Points (9)	Read/Write
f. Effective Temp Set Point	Read Only
g. Offset Lever Enable	Read/Write
h. Offset Lever % of Range	Read/Write
i. Cooling Demand	Read Only
j. Heating Demand	Read Only
k. Heat Delivered (BTU)	Read Only
l. Auxiliary Temp Control Demand	Read Only
7. Humidity Control (per Zone)	
a. Space Humidity	Read Only
b. Humidity Set Point	Read/Write
c. Humidity Demand	Read Only
8. Active Pressure Control (per Zone) <i>Points are available on systems using Active Pressure Control</i>	
a. Zone Pressure	Read Only

b. Effective Pressure Set Point	Read/Write
c. Pressure Warning Set Point	Read/Write
d. Pressure Alarm Set Point	Read/Write
e. Zone Pressure Alarm	Read Only
f. Sensor Failure Alarm	Read Only
g. Freeze Mode Time Set Point	Read/Write
h. Freeze Mode Time Remaining	Read Only
i. Freeze Mode Offset Set Point	Read/Write
j. Effective Pressure Control State	Read Only

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. The Laboratory Airflow Control System (LACS) contractor shall install the sash sensors, interface boxes, presence and motion sensor, and fume hood monitor on the fume hood under initial supervision of the laboratory airflow control system supplier. Reel-type sash sensors and their stainless steel cables shall be hidden from view. Bar-type sash sensors shall be affixed to the individual sash panels. Sash interface boxes with interface cards shall be mounted in an accessible location.
- B. The LACS contractor shall install all routers and repeaters in an accessible location in or around the designated laboratory room.
- C. The LACS shall install an appropriately sized and fused 24 Vac transformer suitable for NEC Class II wiring.
- D. All cable shall be furnished and installed by the ATC contractor. The ATC contractor shall terminate and connect all cables as required. The ATC shall utilize cables specifically recommended by the laboratory airflow controls supplier.
- E. The mechanical contractor shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages.
- F. The mechanical contractor shall provide and install all reheat coils and transitions.
- G. The mechanical contractor shall provide and install insulation as required.
- H. Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.
- I. The electrical contractor shall provide a dedicated 120 V circuit to serve the lab controls in each pressurization zone.

### **3.02 SYSTEM START-UP AND TRAINING**

- A. System start-up shall be provided by a factory-authorized representative of the laboratory airflow control system manufacturer. Start-up shall include calibrating the fume hood monitor and any combination sash sensing equipment, as required. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, make-up, general exhaust or return), system programming and integration to BMS (when applicable).

- B. The balancing contractor shall be responsible for final verification and reporting of all airflows.
- C. The laboratory airflow control system supplier shall furnish a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves and general troubleshooting procedures.
- D. Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each training attendee.

**END OF SECTION**

**SECTION 23 21 13  
HYDRONIC PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Hydronic system requirements.
- B. Heating water piping, above grade.
- C. Pipe hangers and supports.
- D. Unions, flanges, mechanical couplings, and dielectric connections.
- E. Valves:
  - 1. Ball valves.
  - 2. Check valves.
- F. Flow controls.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 23 07 19 - HVAC Piping Insulation.
- C. Section 23 21 14 - Hydronic Specialties.

**1.03 REFERENCE STANDARDS**

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- D. ASME B31.9 - Building Services Piping; 2014.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
- G. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
- J. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- K. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

- L. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.
- M. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2006.
- N. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).
- O. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).
- P. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; 2011 and errata.
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- R. AWWA C606 - Grooved and Shouldered Joints; 2011.
- S. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- C. Project Record Documents: Record actual locations of valves.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum 3 years of experience.
- B. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

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

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 50 year limited warranty on press fittings from date of installation.

## **PART 2 PRODUCTS**

### **2.01 HYDRONIC SYSTEM REQUIREMENTS**

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
  - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
  - 2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
  - 3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
- D. Valves: Provide valves where indicated:
  - 1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
  - 2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
  - 3. In heating water systems, butterfly valves may be used interchangeably with gate and globe valves.
  - 4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

### **2.02 HEATING WATER PIPING, ABOVE GRADE**

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
  - 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
  - 1. Fittings: ASME B16.18, cast brass/bronze or ASME B16.22, wrought copper and bronze.
  - 2. Solder Joints:
    - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
    - b. Braze: 1 BCuP copper/silver alloy.
  - 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
  - 4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, non toxic synthetic rubber sealing elements. Sealing elements shall be factory installed by fitting manufacturer. Press ends shall have means to indicate non-pressed fitting during pressure test.
    - a. Manufacturers:
      - 1) Viega LLC.
      - 2) Nibco.

### **2.03 EQUIPMENT DRAINS AND OVERFLOWS**

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
  - 1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
  2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
1. Fittings: ASTM D2466 or D2467, PVC.
  2. Joints: Solvent welded in accordance with ASTM D2855.

## **2.04 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.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.
- C. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
- D. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- F. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- G. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- H. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

## **2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS**

- A. Unions for Pipe 2 Inches and Less:
1. Ferrous Piping: 150 psig malleable iron, threaded.
  2. Copper Pipe: Bronze, soldered joints.
- B. Dielectric Connections:
1. Waterways:
    - a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
    - b. Dry insulation barrier able to withstand 600 volt breakdown test.
    - c. Construct of galvanized steel with threaded end connections to match connecting piping.
    - d. Suitable for the required operating pressures and temperatures.
  2. Flanges:
    - a. Dielectric flanges with same pressure ratings as standard flanges.
    - b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
    - c. Dry insulation barrier able to withstand 600 volt breakdown test.



- d. Construct of galvanized steel with threaded end connections to match connecting piping.
- e. Suitable for the required operating pressures and temperatures.

## **2.06 BALL VALVES**

### **A. Manufacturers:**

- 1. Nibco, Inc; Model S-585-70-66.
- 2. Watts.
- 3. Apollo.
- 4. Jomar.

### **B. Up To and Including 2 Inches:**

- 1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

## **2.07 BUTTERFLY VALVES**

### **A. Manufacturers:**

- 1. Nibco; Model LD 2000.
- 2. Crane Valve.
- 3. Milwaukee Valve Company.

**B. Body:** Ductile iron with resilient molded-in EPDM seat, lug ends, extended neck.

**C. Disc:** Construct of aluminum bronze, geometric drive (one piece stem, no pin through disc).

**D. Stem:** Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.

**E. Operator:** 10 position lever handle.

## **2.08 SWING CHECK VALVES**

### **A. Manufacturers:**

- 1. Nibco, Inc.
- 2. Stockham.
- 3. Grinnell.
- 4. Jomar.

### **B. Up To and Including 2 Inches:**

- 1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
- 2. Nibco Model S-433-Y.

### **C. Over 2 Inches:**

- 1. Iron body, bronze trim, bronze faced rotating swing disc, renewable disc and seat, flanged ends.
- 2. Nibco Model F-918-B.

## **2.09 FLOW CONTROLS**

**A. Construction:** Class 125, Brass or bronze body with union on inlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment using jointing system specified.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for additional requirements.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully inserted in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.
- C. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- D. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- E. Install piping to conserve building space and to avoid interfere with use of space.
- F. Group piping whenever practical at common elevations.
- G. Sleeve pipe passing through partitions, walls and floors.
- H. Slope piping and arrange to drain at low points.
- I. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- J. Use eccentric reducers to maintain top of pipe level.
- K. Install valves with stems upright or horizontal, not inverted.

### 3.03 SCHEDULES

#### A. Hanger Spacing for Copper Tubing.

1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.

#### B. Hanger Spacing for Steel Piping.

1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.

**END OF SECTION**

**SECTION 23 21 14  
HYDRONIC SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Air vents.
- B. Strainers.
- C. Pressure-temperature test plugs.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 21 13 - Hydronic Piping.

**1.03 REFERENCE STANDARDS**

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

**PART 2 PRODUCTS**

**2.01 AIR VENTS**

- A. Manufacturers:
  - 1. ITT Bell & Gossett.
  - 2. Taco, Inc.
  - 3. Armstrong Fluid Technologies.
- B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. Float Type:
  - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
  - 2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

**2.02 STRAINERS**

- A. Manufacturers:
  - 1. Wilkins.
  - 2. Watts Regulator.
- B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

### **2.03 PRESSURE-TEMPERATURE TEST PLUGS**

- A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.
- B. Application: Use extended length plugs to clear insulated piping.

### **2.04 AUTOMATIC FLOW CONTROLS**

- A. Manufacturers:
  1. Nexus.
  2. Flow Design.
  3. Griswold controls.
  4. Hays Fluid Controls.
- B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.
- D. Control Mechanism:
  1. Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring. Internal flow cartridge shall be permanently marked with GPM and spring range. Cartridge shall be removable for changeout.
  2. Precision sculptured brass or polyphenylsulfone orifices with high temperature elastomeric diaphragm. Internal flow parts shall be permanently marked with flow performance. Components shall be removable for changeout.
- E. Accessories: In-line strainer on inlet and ball valve on outlet.
- F. Provide a differential pressure test kit to verify flow and measure overheating. The kit shall consist of a 4-1/2" diaphragm gauge equipped with ten foot hoses and P/T adapters all housed in a vinyl case.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install specialties in accordance with manufacturer's instructions.
- B. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

**END OF SECTION**

**SECTION 23 31 00  
HVAC DUCTS AND CASINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal ductwork.
- B. Duct cleaning.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- C. Section 23 07 13 - Duct Insulation: External insulation.
- D. Section 23 09 26 - Laboratory Airflow Control System.
- E. Section 23 33 00 - Air Duct Accessories.
- F. Section 23 36 00 - Air Terminal Units.
- G. Section 23 37 00 - Air Outlets and Inlets.

**1.03 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; 2015.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for air systems.
- C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

## **1.06 REGULATORY REQUIREMENTS**

- A. Construct ductwork to NFPA 90A standards.

## **1.07 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**

### **2.01 MATERIALS**

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
- B. PVC Coating for Steel Ducts: 4 mils polyvinyl chloride plastic on both sides.
- C. 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. VOC Content: Not more than 250 g/L, excluding water.
  - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
  - 4. For Use With Flexible Ducts: UL labeled.
- D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- E. Ducts: Galvanized steel, unless otherwise indicated.
- F. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.
- G. Medium and High Pressure Supply: 4 inch w.g. pressure class, galvanized steel.
- H. Return and Relief: 1 inch w.g. pressure class, galvanized steel.
- I. General Exhaust: 1 inch w.g. pressure class, galvanized steel.
- J. Fume Hood Exhaust: 2 inch w.g. pressure class, galvanized steel with PVC coating.
- K. Ductmate or WDCI duct connection systems are acceptable. Ductwork constructed using these systems shall refer to manufacturer's recommendations for sheet metal gage intermediate and joint reinforcement.
- L. Interior gaskets for flanged connections shall be Ductmate 440 butyl rubber.

### **2.02 DUCTWORK FABRICATION**

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

- B. Transfer Air and Sound Boots: 1/2 inch w.g. pressure class, lined galvanized steel.
- C. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.
- D. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- E. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

## **2.03 MANUFACTURED DUCTWORK AND FITTINGS**

- A. Flexible Ducts: Multiple layers of aluminum laminate supported by helically wound spring steel wire.
  1. Insulation: Fiberglass insulation with aluminized vapor barrier film.
  2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
  3. Maximum Velocity: 4000 fpm.
  4. Temperature Range: Minus 20 degrees F to 210 degrees F.
- B. 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).

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. PVC Coated Metal Ductwork: Tape with PVC tape.
- E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- F. Duct sizes indicated shall be of sizes indicated. However, necessary changes in shape offsets or crossovers to clear piping, lighting, building construction obstructions, etc. shall be made without additional cost.
- G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with



spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

- H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Connect terminal units to supply ducts with 1 foot maximum length of flexible duct. Do not use flexible duct to change direction.
- K. 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.

### **3.02 CLEANING**

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

**END OF SECTION**

**SECTION 23 33 00  
AIR DUCT ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Duct access doors.
- D. Duct test holes.
- E. Flexible duct connections and forming brace.
- F. Volume control dampers.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 23 31 00 - HVAC Ducts and Casings.
- C. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.

**1.03 REFERENCE STANDARDS**

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect dampers from damage to operating linkages and blades.

**PART 2 PRODUCTS**

**2.01 AIR TURNING DEVICES/EXTRACTORS**

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

**2.02 BACKDRAFT DAMPERS - METAL**

- A. Manufacturers:
  - 1. Ruskin Company.
  - 2. Vent Products.
- B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

**2.03 DUCT ACCESS DOORS**

- A. Manufacturers:
  - 1. Acudor Products Inc.
  - 2. Ruskin Company.

### 3. Vent Products.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

1. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

## 2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

## 2.05 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.

## 2.06 FLEXIBLE DUCTS FORMING BRACE

A. Manufacturers:

1. Titus; Model FlexRight.

2. Substitutions: See Section 01 60 00 - Product Requirements.

B. UL Listed. Radius forming brace to hold flexible duct into a 90 degree elbow. Fits flexible duct sizes and diffuser inlets from 4 inches to 16 inches in diameter. Manufactured from copolymer polypropylene.

## 2.07 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Ruskin Company.

2. Greenheck.

3. Air Balance.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 by 30 inch.

1. Fabricate for duct sizes up to 6 by 30 inch.

2. Blade: 24 gage, 0.0239 inch, minimum.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

1. Blade: 18 gage, 0.0478 inch, minimum.

- 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.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

## **2.08 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.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- F. 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.
- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**END OF SECTION**

**SECTION 23 34 23  
POWER VENTILATORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Ceiling exhaust fans.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.
- B. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.03 REFERENCE STANDARDS**

- A. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; <http://www.amca.org/certified/search/company.aspx>.
- B. AMCA 99 - Standards Handbook; 2010.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - 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.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

**1.05 QUALITY ASSURANCE**

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Greenheck.
- B. Loren Cook Company.
- C. Twin City.

**2.02 POWER VENTILATORS - GENERAL**

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Conform to AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## **2.03 CABINET AND CEILING EXHAUST FANS**

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- C. Grille: Aluminum with baked white enamel finish.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

**END OF SECTION**

**SECTION 23 35 18**  
**LABORATORY EXHAUST SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Mixed-flow induced dilution fans.
- B. Motors, controllers, disconnects and drives.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.03 REFERENCE STANDARDS**

- A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).
- C. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating.
- D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; <http://www.amca.org/licenses/search.aspx>.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.
- F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.
- G. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- H. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- I. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association; 2000.
- J. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).

**1.04 PERFORMANCE REQUIREMENTS**

- A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- B. Fabrication: Conform to AMCA 99.
- C. Performance Base: Sea level conditions.

- D. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.
- E. Fan shall be listed by Underwriters Laboratories (UL/cUL 705) for US and Canada. (if disconnects are supplied by fan manufacturer). Fan shall bear the AMCA certified ratings seal for air and sound performance.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on centrifugal 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.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

### **1.06 WARRANTY**

- A. Fan manufacturer shall provide a 7 year parts warranty from time of purchase to include fan, plenum, motor and drive mechanisms including pillow blocks, sheaves, shafts, couplings and belts. This warranty shall be held solely by the fan manufacturer. It is unacceptable to extend the warranty of a provided component supplier (i.e. motors, dampers, actuators). All warranty claims shall be the sole responsibility of the fan manufacturer.

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

- A. Protect motors, shafts, and bearings from weather and construction dust.

### **1.08 FIELD CONDITIONS**

- A. Permanent fans may not be used for ventilation during construction.

## **PART 2 PRODUCTS**

### **2.01 MIXED-FLOW INDUCED DILUTION FANS**

- A. Manufacturers:
  - 1. Strobic Air Corp; Model Tri-stack.
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Impellers shall be mounted directly to the motor shaft to provide Arrangement 4 Direct Drive. Motors shall be isolated from the primary exhaust air stream and shall be visible and accessible from the fan exterior for inspection and service. Models that are not Arrangement #4 will be rejected.
- C. Mixed flow impellers shall consist of combination axial/backward curved blades and shall be of welded steel construction. The impellers shall have non-stall and non-overloading performance characteristics with aerodynamically stable operation at any point on the fan curves.
- D. Fan Performance shall be scheduled on the Drawings. The Static Pressure stated on the schedule shall be at the inlet to the "Fan System" and does not include any losses of equipment provided by the fan manufacturer (ie: HRU, Filters, Silencers, etc...). All losses for the equipment



provided by the fan manufacturer shall be detailed in the fan manufacturers technical proposal and or submittal.

- E. Fan and all drive components shall have a combined bearing life of a minimum of L10 = 150,000 hours.
- F. Maintenance shall only be required on a minimum of 18 month intervals. This maintenance shall be limited to re-greasing of the motor bearings.
- G. Stationary discharge guide vane sections shall be provided to increase fan efficiencies.
- H. Fan dynamic balance not to exceed 0.5 mil, peak-to-peak for nominal 900RPM, 1200RPM, and 1800RPM fans, or 0.055 in/sec -peak for 1800 RPM, 0.035 in/sec - peak for 1200 RPM, and 0.030 in/sec-peak for 900 RPM fans measured at the blade pass area when operating at fan frequency. Vibration isolation shall be limited to rubber-in-shear pad type isolators unless otherwise specified.
- I. Factory test reports detailing vibration levels at the blade pass area shall be provided. Vibration levels shall be reported in both the axial and radial direction. If fan vibration is greater than 0.5 mils peak-to-peak at the blade pass area, fan manufacturer shall be responsible for providing vibration isolators on each fan and flexible connection at each duct inlet. Manufacturer shall add 0.5" additional static pressure to the fan system to compensate for losses through the flexible connection. Vibration isolators, 2" deflection seismic rated spring, must be installed on each individual fan with a minimum of four per fan. In addition, fan manufacturer shall be responsible for providing a method to repair or replace flexible connection or vibration isolators without shut down of the fan system. This includes any engineering, additional ductwork, and isolation dampers required to perform repairs while the system is still fully operational. Fan manufacturer shall also provide labor to change out or repair flexible connection and vibration isolators for a seven (7) year period from shipment.
- J. If a belt drive fan is supplied the fan manufacturer shall include a seven (7) year service contract for maintaining the belts, sheaves and drive mechanism. This is to include monthly inspections as noted in the ANSI Z9.5, 4.14.7.2 and any tensioning, and belt replacement during the seven (7) year period. This contract shall be detailed in the proposal and included in its total value.
- K. Fan assemblies shall be designed for mounting on conventional roof curb without the need for guy wire supports.
- L. Discharges shall include twin FRP nozzles with passive third central stacks that are capable of generating aspiration. The FRP shall be chemically and UV resistant.
- M. Entrainment windbands shall provide secondary induction of outside air. Induction shall take place downstream of the fan impeller and shall not influence BHP or static pressure requirements. Windbands shall discharge up to 270% of the design flow rates. The manufacturer shall publish discharge volumes for all fans at specified primary exhaust flow.
- N. Fan shall be constructed to AMCA "C" standards per AMCA 99 with a non-ferrous inlet bell provided in order to reduce sparking in the event of a motor bearing failure.
- O. Fans shall be modular construction and capable of being assembled on the roof.
- P. Chemical resistant gaskets shall be provided at all companion flanged joints.

- Q. Fasteners shall be 316 stainless steel.
- R. A bolted access door shall be provided for impeller inspection on each fan.
- S. Fans and accessories shall have internal drain systems to prevent rain water from entering building duct system.
- T. Electric motors shall be TEFC Mill & Chemical duty with a 1.15 service factor and an L10 bearing life of 150,000 hours. Premium Efficient motors shall have regreasable bearings with grease relief fittings in every NEMA frame. Fan motors shall be C-Face and foot mounted.
- U. Extended motor lube lines of Teflon tubing covered with braided stainless steel shall be provided. Extended lube lines shall be mounted to a bracket located on the fan housing with grease relief fittings on each line.
- V. A NEMA 3R non-fused disconnect switch shall be provided, mounted and wired to the motor.
- W. All steel and aluminum surfaces components within the airstream that are not stainless steel or fiberglass must be surface prepped by abrasive blast clean to SSPC-SP10. Chemically cleaning of these components as a form of surface preparation is not acceptable. These components must be coated with a high solids epoxy with low VOC chemical resistant barrier coating epoxy. The coating system, a total thickness of up to 12 mils, is not affected by the UV component of sunlight (does not chalk), and has superior corrosion resistance to acid, alkali, and solvents. Coating system shall exceed 7000 hour ASTM B117 Salt Spray Resistance. Standard finish color to be gray. All coatings that include a zinc rich epoxy primer are strictly prohibited. Zinc coatings react with alkalis and acids, thus causing premature failure of the coating system and should never be used for laboratory applications.
- X. The fan supplied must meet the system exhaust CFM and the motor BHP shall not be larger than that shown on the fan schedule. If the BHP is larger than that shown then the fan manufacturer shall provide money for the additional energy cost for a seven (7) year period. The cost shall be \$7,530.00 per BHP greater than that shown in the schedule. The fan manufacturer shall also provide any additional money required for wiring changes or any other changes required for installation of the equipment. These additional charges shall be detailed on the proposal and include in its total value.
- Y. The static pressure shown on the schedule is based on the static pressure requirements at the inlet to the mixing box. Any system deviating from the basis of design shall include and detail in their proposal additional losses for flexible connectors, fan losses, elbows, mixing box, etc. that are not included in their fan curves.
- Z. Accessories:
1. Inlet mixing plenums shall be provided by the fan manufacturer. Each plenum shall be sized to support the weight and performance requirement of the number of fans listed on the schedule. Multiple fan plenums shall be insulated double wall construction with structural stiffeners. Double wall plenums, except for fans over 3hp shall have an overall minimum wall thickness of 1.5", and the insulation shall have a minimum R value of 4.34. Outer skin of double wall plenums shall be coated 12Ga Galvaneal steel. Inner skin shall be uncoated 18Ga 304 stainless steel. Multiple fan plenums shall be able to withstand a minimum of 12 in. w.g. of

negative pressure. Single fan plenums shall be of continuously welded, heavy gauge steel construction. For single thickness plenums, coatings shall be the same as specified for the fans. All plenums shall be capable of supporting the fan(s) without guy wires or supports. The plenums shall include hinged access doors. The primary air inlets shall be located on the bottom or side as noted on construction drawings. Unless otherwise specified, plenums shall be suitable for mounting on roof curbs. Safety screens shall be supplied over inlet of fan.

2. Bypass dampers shall be provided with all mixing plenums for outside air with primary exhaust. Bypass damper(s) shall be sized to bypass the airflow capacity of one fan at the required static pressure of the system. Dampers will be opposed blade low leakage air foil control dampers with extended shaft for connection to an operator. The dampers shall be all aluminum construction. Rain hoods shall be provided with each damper. The dampers shall be controlled by a 24v electric proportional control damper actuators shall be electronic direct-coupled type, which require no crankarm and linkage. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500 $\Omega$  resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have Brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication.
3. Low leakage isolation dampers shall be constructed of aluminum air foil extrusions and epoxy coated. Operators shall be 2 position, spring return and shall have On-off spring return damper actuators that are direct coupled type which require no crankarm and linkage and be capable of direct mounting to a jackshaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have a manual positioning mechanism accessible on its cover. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. Run time shall be constant and independent of torque. Auxiliary switches, 2 SPDT, shall be provided with one switch having the capability of being adjustable.
4. A galvanized steel roof curb shall be provided to support the fans/plenums. The curb shall be minimum 14 gauge and canted for rigidity in wind loads. The curb shall include a rigid fiberglass liner and a wood nailer.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

**END OF SECTION**

**SECTION 23 37 00  
AIR OUTLETS AND INLETS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Diffusers.
- B. Registers/grilles.
- C. Roof hoods.

**1.02 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 (Rev. 2009).

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - 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.

**1.04 QUALITY ASSURANCE**

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Price Industries.
- B. Titus.
- C. Tuttle & Bailey.
- D. Nailor.

**2.02 SQUARE CEILING DIFFUSERS**

- A. Type: Provide square, stamped, multi-core diffuser to discharge air in four way pattern.
- B. Connections: As scheduled on drawings.
- C. Frame: Provide inverted T-bar type.
- D. Fabrication: Steel with baked enamel finish.
- E. Color: As selected by Architect/Engineer from manufacturer's standard range.

F. Accessories: Provide radial opposed blade volume control damper; removable core with damper adjustable from diffuser face.

G. Titus Model TMS.

### **2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES**

A. Type: Streamlined aero blades, 1 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect/Engineer from manufacturer's standard range.

E. Provide with plenum box on back of grilles with round connection.

F. Titus Model 23RL.

### **2.04 WALL SUPPLY REGISTERS/GRILLES**

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Color: To be selected by Architect/Engineer from manufacturer's standard range.

D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

E. Titus Model 300RS.

### **2.05 ROOF HOODS**

A. Fabricate air inlet or exhaust hoods in accordance with SMACNA (DCS).

B. Fabricate of galvanized steel, minimum 16 gage, 0.0598 inch base and 20 gage, 0.0359 inch hood, or aluminum, minimum 16 gage, 0.0598 inch base and 18 gage, 0.0598 inch hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory prime coat finish.

C. Mount unit on minimum 12 inch high curb base with insulation between duct and curb.

D. Make hood outlet area minimum of twice throat area.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

**END OF SECTION**

**SECTION 23 74 13**  
**PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Packaged roof top unit.
- B. Unit controls.
- C. Roof mounting curb and base.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.03 REFERENCE STANDARDS**

- A. AFBMA 9 - Load Ratings for Fatigue Life for Ball Bearings.
- B. AMCA 99 - Standards Handbook
- C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- D. AMCA 500 - Test Methods for Louver, Dampers and Shutters.
- E. AHRI 340/360 - Unitary Large Equipment.
- F. NEMA MG1 - Motors and Generators.
- G. National Electrical Code.
- H. NFPA 70 - National Fire Protection Agency.
- I. SMACNA - HVAC Dust Construction Standards - Metal and Flexible.
- J. UL 900 - Test Performance of Air Filter Units.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Factory start-up forms.

- G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Filters: One set for each unit.

### **1.05 QUALITY ASSURANCE**

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

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

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressors.
- C. Provide a five year warranty to include coverage for heat exchangers.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.
- B. Trane, a brand of Ingersoll Rand.
- C. Daikin.
- D. Aeon.

### **2.02 MANUFACTURED UNITS**

- A. General: Roof mounted units having gas burner and electric refrigeration.
- B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
- C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
- D. Disconnect Switch: Factory mount disconnect switch in control panel.

### **2.03 FABRICATION**

- A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, 0.0478 inch, with access doors or panels of minimum 20 gage, 0.0359 inch.



- B. Insulation: 1/2 inch thick foiled faced glass fiber with edges protected from erosion.
- C. Heat Exchangers: Aluminized steel, of welded construction.
- D. Supply Fan: Variable speed, direct drive motors, themally protected.
- E. Air Filters:
  - 1. 2 inch thick MERV 8 glass fiber disposable media in metal frames.

#### **2.04 BURNER**

- A. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

#### **2.05 EVAPORATOR COIL**

- A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.
- B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

#### **2.06 COMPRESSOR**

- A. Scroll type, inverter control, variable speed compressor capable of speed modulation from 15 Hz to 60 Hz. Motor shall be a permanent magnet type. Resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, suction and discharge service valves, gage ports and filter drier.

#### **2.07 CONDENSER COIL**

- A. Provide copper tube aluminum fin microchannel coil assembly.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.
- C. Provide refrigerant pressure switches to cycle condenser fans.

#### **2.08 OPERATING CONTROLS - SINGLE ZONE UNITS**

- A. Factory mounted microprocessor controls shall control heating, cooling and ventilating utilizing input that measure indoor and outdoor temperatures and zone temperature.
- B. Single Zone Variable Air Volume control scheme.
- C. Provide with controls interface with existing Delta Controls buidling automation system. Verify LonTalk or BACnet requirement.

## **2.09 OPTIONS**

- A. Differential enthalpy economizer.
- B. Enhanced dehumidification.
- C. Phase monitoring.
- D. Fault detection and diagnostics (FDD) system.
- E. Powered GFCI convenience outlet.

## **2.10 CURBS**

- A. Curbs to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.
- B. Knockdown curbs (with duct support rails) shall be factory furnished for field assembly.
- C. Solid bottom curb shall be factory assembled and fully lined with 1 inch neoprene coated fiberglass insulation and include a wood nailer strip.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.
- C. Provide p-trap on condensate drain outlets and pipe to nearest roof drain.

### **3.03 SYSTEM STARTUP**

- A. Prepare and start equipment. Adjust for proper operation.

### **3.04 CLOSEOUT ACTIVITIES**

- A. Demonstrate operation to Owner's maintenance personnel.

**END OF SECTION**

**SECTION 23 82 00**  
**CONVECTION HEATING AND COOLING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Cabinet unit heaters.
- B. Air coils.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 21 13 - Hydronic Piping.
- B. Section 23 21 14 - Hydronic Specialties.
- C. Section 23 31 00 - HVAC Ducts and Casings.
- D. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

**1.03 REFERENCE STANDARDS**

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at [www.ahrinet.org](http://www.ahrinet.org).
- B. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Shop Drawings:
  - 1. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- D. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Filters: One set of each type and size.

## **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## **PART 2 PRODUCTS**

### **2.01 HYDRONIC CABINET UNIT HEATERS**

- A. Manufacturers:
  - 1. Sterling Hydronics a Mestek Company.
  - 2. Trane, a brand of Ingersoll Rand.
  - 3. Vulcan.
- B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.
- C. Coils:
  - 1. Evenly spaced aluminum fins mechanically bonded to copper tubes.
- D. Cabinet: Minimum 16 gage, 0.0598 inch thick sheet steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation, integral air outlet, and inlet grilles.
- E. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.
- F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.
- H. Control: Factory wired, solid state, infinite speed control, located in cabinet.
- I. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

### **2.02 AIR COILS**

- A. Manufacturers:
  - 1. Water Coils:
    - a. Aerofin Corporation.
    - b. Trane, a brand of Ingersoll Rand.
    - c. USA Coil & Air.
- B. Water Coils:
  - 1. Coils rated and tested in accordance with AHRI 410.
  - 2. Tubes: Material to consist of seamless copper, mechanically expanded or tension wound to fins; appropriate tube joining methods based on tube material.

3. Fins: Material to consist of aluminum or copper, continuous plate type with full fin collars or individual helical finned tube type wound under tension.
4. Casing: Heavy gage galvanized steel with mounting holes, including intermediate tube supports if required by coil design and length.
5. Headers (Manifolds): Construct of seamless copper pipe or nonferrous material with tube connection appropriate to header material provided.
6. Acceptable Factory Testing Methods:
  - a. Proof test at 1.5 times the maximum operating pressure and leak test at the maximum operating temperature.
  - b. Leak test at minimum 300 psig air pressure under water.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are suitable for installation.
- B. Verify that field measurements are as shown on the drawings.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's recommendations.
- B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
- C. Do not damage equipment or finishes.
- D. Cabinet Unit Heaters:
  1. Coordinate to ensure correct recess size for recessed units.
- E. Air Coils:
  1. Install in ducts and casings in accordance with SMACNA (DCS).
    - a. Support coil sections independent of piping on steel channel or double angle frames and secure to casing.
    - b. Provide airtight seals between coil and duct.
  2. Coil Safeguards:
    - a. Protect coils to prevent damage to flanges and fins.
    - b. Comb out damaged fins.
  3. Install all coils level.
  4. Make connections to hydronic coils with unions and flanges.

### **3.03 CLEANING**

- A. Vacuum clean coils and inside of units.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.
- C. Install new filters.

### **3.04 PROTECTION**

A. Provide finished cabinet units with protective covers during the balance of construction.

**END OF SECTION**

**SECTION 26 05 00**  
**BASIC ELECTRICAL REQUIREMENTS**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 SECTION INCLUDES**

- A. Basic Electrical Requirements and materials specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements. Section includes:
  1. Electrical Identification.
  2. Minor Demolition.
  3. Conductors and Devices.
  4. Raceways and Boxes.
  5. Supporting Devices.

**1.03 REGULATORY REQUIREMENTS**

- A. Conform to NFPA 70 - National Electrical Code, latest edition with amendments as adopted by the City of Joliet, IL.
- B. Conform to building codes as adopted by the City of Joliet, IL.
- C. Install electrical Work in accordance with the NECA Standard of Installation.

**1.04 DELIVERY, STORAGE AND HANDLING**

- A. Store and protect all materials as specified under the provisions of Section 01 60 00 and as specified herein.
- B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- C. Ship products to the job site in their original packaging. Receive and store products in a suitable manner to prevent damage or deterioration. Keep equipment upright at all times.
- D. Investigate the spaces through which equipment must pass to reach its final destination. Coordinate with the manufacturer to arrange delivery at the proper stage of construction and to provide shipping splits where necessary.

**1.05 PROJECT/SITE CONDITIONS**

- A. Install work in locations shown on Drawings, unless prevented by Project conditions. Drawings have omitted certain branch circuitry in areas for ease of reading. All branch circuitry is to be provided by Contractor.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission from Architect/Engineer before proceeding as specified under modification procedures.

## **1.06 QUALITY ASSURANCE**

- A. Provide Work as required for a complete and operational electrical installation.
- B. All products shall be designed, manufactured, and tested in accordance with industry standards. Standards, organizations, and their abbreviations as used hereafter, include the following:
  - 1. American National Standards Institute, Inc (ANSI).
  - 2. American Society for Testing and Materials (ASTM).
  - 3. National Electrical Manufacturers Association (NEMA).
  - 4. Underwriters Laboratories, Inc. (UL).
- C. Install all Work in accordance with the NECA Standard of Installation.

## **1.07 SUBMITTALS**

- A. Submit all requested items in Division 26 Sections under provisions of Section 01 30 00.

## **1.08 SUBSTITUTIONS**

- A. Substitutions will be considered only as allowed within the provisions of Section 01 60 00.

## **1.09 PROJECT RECORD DOCUMENTS**

- A. Cooperate and assist in the preparation of project record documents under the provisions of Section 01 78 00.

## **1.10 TRENCHING, FILL AND COMPACTION**

- A. Provide trenching, fill and compaction for all work indicated on Drawings and specified in Division 26 sections.

## **1.11 PROJECT MANAGEMENT AND COORDINATION**

- A. Proper project management and coordination is critical for a successful project. Manage and coordinate the Work with all other trades in accordance with Section 01 30 00 requirements. Reliance on the Drawings and Specifications only for exact project requirements is insufficient for proper coordination.

## **PART 2 PRODUCTS**

### **2.01 WIRING METHODS**

- A. All locations: Building wire in raceway.
- B. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
  - 1. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet. Use minimum #10 AWG conductor wire in all the following locations:
    - a. All programmable panel branch circuits (larger where indicated).
    - b. All emergency lighting and exit branch circuits.

### **2.02 WIRE AND CABLE**

- A. Manufacturers:



1. Okonite.
  2. Southwire.
  3. Collyer.
- B. Building Wire:
1. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation.
  2. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, stranded conductor (solid for device terminations).
  3. Control Circuits: Copper, stranded conductor, 600 volt insulation.
  4. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
  5. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
  6. Use conductor not smaller than 12 AWG for power and lighting circuits.
  7. Use conductor not smaller than 16 AWG for control circuits.
- C. Locations:
1. Concealed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
  2. Exposed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
  3. Above Accessible Ceilings: Use only building wire with Type THHN insulation in raceway.
  4. Wet or Damp Interior Locations: Use only building wire with Type THWN insulation in raceway.
  5. Exterior Locations: Use only building wire with Type XHHW insulation in raceway.
  6. Underground Installations: Use only building wire with Type XHHW insulation in raceway.

### **2.03 WIRING DEVICES AND WALL PLATES**

- A. Single Pole Switch: Specification grade.
1. Hubbell Model 1121.
  2. P & S Model 521.
  3. Leviton Model 1121.
  4. Color: Ivory.
- B. Three-way Switch: Specification grade.
1. Hubbell Model 1123.
  2. P & S Model 523.
  3. Leviton Model 1123.
  4. Color: Ivory.
- C. Four-way Switch: Specification grade.
1. Hubbell Model 1124.
  2. P & S Model 524.
  3. Leviton Model 1124.
  4. Color: Ivory.
- D. Single-pole LED Dimmer Switch: Specification grade.
1. Leviton IP710-LFZ
  2. Description: Linear slide fluorescent dimmer, compatible with ballast and number of lamps.
  3. Voltage: 277 volt.

4. Power Rating: Match load shown on drawings.
- E. Duplex Convenience Receptacle: Nema 5-20R, duplex, specification grade.
  1. Hubbell.
  2. Bryant.
  3. Leviton.
  4. Color: Ivory.
- F. GFCI Receptacle: Nema 5-20R, duplex, GFCI, specification grade.
  1. Hubbell Model GF-5362.
  2. Slater Model SIR-20-F.
  3. Eagle Model 647.
  4. Color: Ivory.
- G. Decorative Cover Plate:
  1. Hubbell.
  2. Bryant.
  3. Leviton.
  4. Description: Stainless Steel, metal.
- H. Weatherproof die cast cover.
  1. Intermatic Model WP1030MC (Two-Gang).
  2. Approved Equal.
- I. Special Purpose Receptacles:
  1. Hubbell.
  2. P & S.
  3. Leviton.
  4. Description: Nema configuration as shown on Drawings unless noted otherwise.

## **2.04 RACEWAY REQUIREMENTS**

- A. Use only specified raceway in the following locations:
  1. Branch Circuits and Feeders:
    - a. Concealed Dry Interior Locations: Electrical metallic tubing.
    - b. Exposed Dry Interior Finished Locations: Electrical metallic tubing.
    - c. Exposed Dry Interior Unfinished Locations: Electrical metallic tubing.
    - d. All other locations: Galvanized Rigid Metallic Conduit.
- B. Size raceways for conductor type installed.
  1. Minimum Size Conduit Homerun to Panelboard: 3/4-inch.

## **2.05 METALLIC CONDUIT AND FITTINGS**

- A. Conduit:
  1. Rigid Steel Conduit: ANSI C80.1.
  2. Electrical metallic tubing: ANSI C80.3.
  3. Flexible Conduit: UL 1, zinc-coated steel.
    - a. Liquidtight Flexible Conduit: UL360. Fittings shall be specifically approved for use with this raceway.

- B. Conduit Fittings:
  - 1. Metal Fittings and Conduit Bodies: NEMA FB 1.
    - a. EMT fittings: Use set-screw indentor-type fittings.

## **2.06 NONMETALLIC TUBING**

- A. Manufacturers:
  - 1. Carlon Co.
  - 2. LCP National Plastics, Inc.
  - 3. Pacific Western Extruded Plastics Co.
- B. Description: UL651A "Type EB and A PVC Conduit and HDPE Conduit."
  - 1. Conduit: Schedule 40. Suitable for exposure to sunlight and direct burial.

## **2.07 CONDUIT HANGERS**

- A. Manufacturers:
  - 1. Minerrallac Electric Company.
  - 2. Substitutions: Or Approved Equal.
- B. Description:
  - 1. Standard conduit hanger, zinc-plated steel with bolts.
  - 2. Threaded rod and hardware: Plated finish, size and length as required for loading and conditions.

## **2.08 BEAM CLAMPS**

- A. Manufacturers:
  - 1. Appleton.
  - 2. Midwest.
  - 3. Raco.
- B. Description: Malleable beam clamp, zinc plated steel.

## **2.09 ELECTRICAL BOXES**

- A. Manufacturers:
  - 1. Raco.
  - 2. Steel City.
  - 3. Appleton.
  - 4. Substitutions: Or Approved Equal.
- B. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel, suitable for installation in masonry:
- C. Equipment Support Boxes: Rated for weight of equipment supported; include 2 inch male fixture studs where required.
- D. Wet Location Outlet Boxes: Cast aluminum: Cast alloy, deep type, gasket cover, threaded hubs.

## **2.10 POP-OPEN ENCLOSURE**

- A. Manufacturers:

1. FSR
2. Hubbell
3. Wiremold

B. Description

1. Recessed table top enclosure with pop-open cover.
2. (1) Double duplex receptacle.
3. Up to 8 Communications devices.
4. Can be installed in any table surface with thickness ranging from .75" to 2.75"

C. Cover:

1. Flush type.
2. Color as selected by Architect.

## **2.11 PEDESTAL ENCLOSURE**

A. Manufacturers:

1. Hubbell.
2. Wiremold.
3. Approved Equal.

B. Description:

1. Above Counter service pedestal.
2. Metallic with aluminum frame and brushed aluminum housing.
3. Up to either (2) duplex receptacles (one on each side of pedestal), (2) GFCI duplex receptacles (one on each side of pedestal) or (8) communications devices (four on each side of pedestal).
4. Bottom of enclosure shall be mounted to counter (stem mounting not acceptable).

C. Cover:

1. Stainless steel.

## **2.12 ELECTRICAL FLOOR BOXES**

A. Manufacturers:

1. Hubbell.
2. Appleton.
3. Walker.

B. Concrete floor slab: Fully adjustable, stamped steel, 3" deep, two compartment (power/data), recessed flip top cover service box style floor box.

C. Provide surface mounted ("dog house" type) service fittings where called out on drawings.

1. Service fitting shall:
  - a. accept up to (2) 1" locking nipples.
  - b. have interchangeable faceplates.

D. Cafeteria: Fully adjustable, cast iron, 4" deep, brass screw covers with threaded brass protective rings for plugs (mechanical/wet mop protection).

## **2.13 MULTI-SERVICE STEEL RECESSED FLOOR BOXES**

A. Manufacturers

1. Hubbell Wiring Devices - Kellems - [www.hubbell-wiring.com](http://www.hubbell-wiring.com)
2. Thomas & Betts Corporation - [www.tnb.com](http://www.tnb.com)
3. The Wiremold Company - [www.wiremold.com](http://www.wiremold.com)

B. Description:

1. Recessed type.
2. Provide capacity of up to six duplex receptacles and/or communication services.
3. Fully adjustable before concrete pour.
4. Openings for up to (4) 1" conduits and (4) 3/4" conduits.

C. Flush Cover and Flange Assembly:

1. Steel Cover with Carpet Flange Assembly.
2. Cover shall provide protection from water, dirt and debris.
3. Cover shall close completely when plugs are connected into receptacles and/or communications jacks.

D. Backbox dimensions (minimum).

1. 10" Length x 10" Width x 3" Depth.

## **2.14 ELECTRICAL CEILING BOXES.**

A. Manufacturers:

1. Panduit.
2. Leviton.
3. Walker.

B. Description: Two gang, separated power/data surface metallic box. Combination duplex receptacle with two port data faceplate, compatible with data jacks. Ivory.

## **2.15 PENETRATION SEALANTS**

A. Fire-rated assemblies: Provide firestopping of all penetrations made by Work under this Contract in accordance with provisions of Section 07 84 00 requirements.

B. Thermal and Moisture Protection: Provide thermal and moisture protection made by Work under this Contract of all exterior wall, floor and roof penetrations in accordance with Division 7 requirements.

## **2.16 TWO CELL SURFACE METALLIC RACEWAY**

A. Manufacturer:

1. Wiremold G-4000 Series or equal.

B. Description: UL-5, 4-3/4 inches wide by 1-3/4 inches height, two channel galvanized steel, combination power/data.

C. Finish: Painted, ANSI 61 Gray.

D. Accessories: Transition fittings, divider plates, device mounting straps, couplings, combination power/data cover plates, end plates and all other accessories necessary for a complete system in locations indicated on Drawings.

## **2.17 TWO CELL LOW PROFILE SURFACE METALLIC RACEWAY**

- A. Manufacturer:
  - 1. Wiremold 2400 Series or equal.
- B. Description: UL-5, 2 inches wide by 1 inch height, two channel galvanized steel, combination power/data.
- C. Finish: Painted, ANSI 61 Color Selected by architect.
- D. Accessories: Transition fittings, divider plates, device mounting straps, couplings, combination power/data cover plates, end plates and all other accessories necessary for a complete system in locations indicated on Drawings.

## **2.18 TWO CELL SURFACE NON-METALLIC RACEWAY**

- A. Manufacturer:
  - 1. Wiremold 5400 Series or equal.
- B. Description: UL-5A, 5-1/4 inches wide by 1-3/4 inches height, two channel with individual (twin snap) compartment covers, combination power/data.
- C. Finish: White.
- D. Accessories: Transition fittings, divider plates, device mounting straps, couplings, combination power/data cover plates, end plates and all other accessories necessary for a complete system in locations indicated on Drawings.

## **2.19 POP-OPEN ENCLOSURE**

- A. Manufacturers
  - 1. FSR #T3U-3R - fsrinc.com
  - 2. No Substitutions.
- B. Description
  - 1. Recessed table top enclosure with pop-open cover.
  - 2. Provide double duplex receptacle.
  - 3. Provide space for data jack where required.
- C. Flush Cover:
  - 1. Finish to be selected by Architect.

## **2.20 HAND HOLES**

- A. Manufacturers:
  - 1. Quazite.
  - 2. Approved Equal
- B. Description: Precast polymer concrete or precast concrete, Non-conductive, non-flammable with open bottom. Flanged, non-conductive, gasketed cover enclosure with stainless-steel cover screws.
  - 1. Load Rating: UL listed Tier 22 as suitable for driveway, parking lot and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic.

2. Cover inscribed with "FIELD LIGHTING" or "ELECTRIC" or other suitable description.

## **2.21 WIREWAY**

- A. Manufacturers:
  1. Hoffman.
  2. Cooper Industries.
  3. Approved Equal.
- B. Description:
  1. NEMA Type 1 Lay-In Galvanized Wireway, UL 870. Flat cover design. Size as shown on drawings.
  2. Provide hinged covers where noted on drawings.
  3. Provide all elbows, tee's, covers and fittings as required
- C. Finish:
  1. To be selected by Architect/Engineer.

## **2.22 MOTION SENSORS**

- A. Manufacturers:
  1. Hubbell - OMNI DT
  2. Approved Equal
- B. Combination Wall Switch/Occupancy Sensor
  1. Dual technology (passive infrared and ultrasonic), 277V sensor with 180degree field-of-view and maximum coverage of 2400 square feet.
  2. Manual push button for ON/OFF light switching.
  3. Time delay settings: 30 seconds, 10, 20 or 30 minutes).
  4. Adjustable Integral blinders.
  5. Sensor shall continuously monitor space to identify usage patterns. Unit shall automatically adjust time delay and sensitivity settings for optimal performance and energy efficiency.
- C. Ceiling Mounted.
  1. Dual technology (passive infrared and ultrasonic), 24VDC sensor with unobtrusive appearance and 360 degrees of coverage.
    - a. Provide type/quantity of motion sensors to meet square foot coverage requirements.
  2. Provide power pack for 24VDC controls and switching of 120/277V circuits. Minimum quantity of sensors per power pack: 2.
  3. Sensor shall continuously monitor space to identify usage patterns. Unit shall automatically adjust time delay and sensitivity settings for optimal performance and energy efficiency.
  4. Time delay settings: Auto, fixed (5,10,15,20 or 30 minutes).
  5. Sensitivity settings: Auto, reduced sensitivity (passive infrared) variable (ultrasonic).
  6. (1) N/O and (1) N/C output.

## **2.23 NAMEPLATES AND LABELS**

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
  1. Each electrical distribution and control equipment enclosure.

C. Letter Size:

1. Use 1/8 inch letters for identifying individual equipment and loads.
2. Use 1/4 inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on a black background. Use only for identification of individual wall switches and receptacles and control device stations.

## **2.24 WIRE AND CABLE MARKERS**

A. Manufacturers:

1. Brady Model PCPS.
2. Panduit Model PCM.
3. T & B Model WM.

B. Description: Cloth type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, and each load connection.

D. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

## **2.25 CONDUIT MARKERS**

A. Location: Furnish markers for each conduit longer than 6 feet.

B. Spacing: 20 feet on center.

C. Color:

1. 480 Volt System: Orange
2. 208 Volt System: Black
3. Fire Alarm System: Red.

## **2.26 UNDERGROUND WARNING TAPE**

A. Description: 4 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION AND PREPARATION**

A. Demolition Drawings are based on casual field observation and are intended to identify the limits of the construction site. Remove all electrical systems in their entirety in proper sequence with the Work.

B. Disconnect electrical systems in walls, floors, and ceilings for removal.

C. 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.

D. Existing Electrical Service and Emergency Electrical Service: Disable system only to make switchovers and connections. Obtain permission from Owner and Architect at least 24 hours



before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

- E. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner, Architect/Engineer and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- F. Beginning of demolition means installer accepts existing conditions.
- G. Verify that supporting surfaces are ready to receive work.
- H. Electrical boxes are shown on Drawings, in approximate locations, unless dimensioned.
  - 1. Obtain verification from Architect/Engineer for locations of outlets throughout prior to rough-in.
- I. Degrease and clean surfaces to receive wire markers.
- J. Verify that interior of building is physically protected from weather.
- K. Verify that mechanical work which is likely to injure conductors has been completed.
- L. Completely and thoroughly swab raceway system before installing conductors.

### **3.02 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Remove all existing electrical 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. Relocate existing fire alarm devices affected by wall, ceiling and floor demolition.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Properly dispose of all ballast to approved ballast recycler. Do not land fill ballasts.

### **3.03 APPLICATION**

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment front using screws.
- C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.
- E. Neatly train and secure wiring inside boxes, equipment, and panelboards.
- F. Use wire pulling lubricant for pulling 4 AWG and larger wires.
- G. Route wire and cable as required to meet project conditions.
  - 1. Wire and cable routing indicated is approximate unless dimensioned.
  - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

- H. Pull all conductors into raceway at same time.
- I. Protect exposed cable from damage.
- J. Neatly train and lace wiring inside boxes, equipment and panelboards.
- K. Support cables above accessible ceilings to keep them from resting on ceiling tiles.
- L. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise.
- M. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- N. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- O. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- P. Do not use powder-actuated anchors.
- Q. Do not drill or cut structural members.
- R. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- S. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- T. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
- U. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- V. Terminate spare conductors with electrical tape.
- W. Do not share neutral conductor on load side of dimmers.
- X. Install wiring devices in accordance with manufacturer's instructions.
  - 1. Install wall switches at height shown on drawings, OFF position down.
  - 2. Install convenience receptacles at height shown on drawings grounding pole on bottom.
  - 3. Install specific purpose receptacles at heights shown on Drawings.
- Y. Install wall plates flush and level.
  - 1. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
  - 2. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

## END OF SECTION

**SECTION 26 27 17  
EQUIPMENT WIRING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electrical connections to equipment and devices not and integral part of the electrical distribution system.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 00 - Basic Electrical Requirements

**1.03 REFERENCE STANDARDS**

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Provide conduit rough-in and electrical connection to powered equipment and devices identified in the Project Manual and on the Drawings. Refer specifically, but not limited to, these Specification Sections for further information:
  - 1. Section 08 36 13 - Sectional Overhead Doors: Motorized operators and other electrified components.
  - 2. Section 11 53 00 - Laboratory Equipment: Motorized or electrified equipment.
  - 3. Section 21 13 00 - Fire Suppression Sprinklers.
  - 4. Section 22 30 00 - Plumbing Equipment
  - 5. Section 23 74 13 - Packaged Outdoor Central-Station Air-Handling Units
  - 6. Section 23 82 00 - Convection Heating and Cooling Units
  - 7. Section 28 31 00 - Fire Detection and Alarm.
  - 8. Section 23 09 23 - Direct-Digital Control System for HVAC.
- B. Coordination: Determine connection locations and requirements for furniture, equipment and devices furnished or provided under other sections.
  - 1. Do not rely solely on the Drawings and Project Manual for execution of the Work of this Section.
  - 2. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions.
  - 3. Include necessary field evaluation time to inspect connection requirements.
  - 4. Coordinate with other trades to determine exact rough-in requirements.
- C. Sequencing:
  - 1. Install rough-in of electrical connections before installation of furniture and equipment is required.
  - 2. Make electrical connections before required start-up of equipment.

## **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- 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.

## **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Conform to NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
  - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
  - 4. Product: Carol.
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

### **3.02 ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

**END OF SECTION**

**SECTION 26 51 00  
LIGHTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Lamps.
- F. Luminaire accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 00 - Basic Electrical Requirements

**1.03 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; National Electrical Contractors Association; 2006.
- C. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.
- D. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- E. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.
- F. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; Illuminating Engineering Society; 2002 (Reaffirmed 2008).
- G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for

- mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
  3. 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.
  4. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
  5. Notify Architect/Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  1. Provide photometric calculations where luminaires are proposed for substitution upon request.
  2. Indicate construction, installation and mounting details for products.
  3. Wiring Diagrams: Submit wiring diagrams for all exit sign, night light, self-contained back-up battery lighting, battery ballasts and associated circuit breakers, programmable circuit breakers and/or emergency circuit breakers.
- 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. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
  3. Wiring diagrams: Provide wiring diagrams for dimmable ballasts and dimmable switches.
- 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. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
- G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

## **1.06 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## **1.07 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.

## **1.08 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

## **1.09 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

## **PART 2 PRODUCTS**

### **2.01 LUMINAIRE TYPES**

- A. Furnish products as specified below.
- B. Substitutions: See Section 01 60 00 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.
- C. Type A: Recessed 2'x2' LED.
  - 1. Products:
    - a. Truly Green Solutions - 882240-40-L-F.
  - 2. Nominal Size: 2 by 2 feet.
  - 3. Ceiling Trim: NEMA type G (grid).
  - 4. Lamp(s): One-40 W LED.
    - a. Correlated Color Temperature: 4,000 K.
  - 5. Voltage: Universal 120-277 V.
  - 6. Driver(s): One 0-10V dimmable driver.
  - 7. Mounting: Lay-in, grid ceiling.
- D. Type B: LED Highbay Strip Light.
  - 1. Products:
    - a. Truly Green Solutions - 175-090-40-01-01-01-01-100/277V.
  - 2. Nominal Length: 2 feet.
  - 3. Lamp(s): One-90W LED.
    - a. Correlated Color Temperature: 4,000 K.
  - 4. Voltage: Universal 120-277 V.
  - 5. Driver(s): One LED non-dimming Driver.



6. Mounting: Surface, ceiling.

## 2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- 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.
- J. LED Luminaire Components: UL 8750 recognized or listed as applicable.

## 2.03 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
  - 1. Sealed maintenance-free lead calcium unless otherwise indicated.
  - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- F. Accessories:
  - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
  - 2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
  - 3. Provide compatible accessory wire guards where indicated.
  - 4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

## **2.04 EXIT SIGNS**

- A. All Exit Signs: Internally illuminated 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.
- B. 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.

## **2.05 BALLASTS AND DRIVERS**

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting: [www.gelighting.com](http://www.gelighting.com).
  - 2. Osram Sylvania: [www.sylvania.com](http://www.sylvania.com).
  - 3. Philips Lighting Electronics/Advance: [www.advance.philips.com](http://www.advance.philips.com).
  - 4. Universal; [www.unvlt.com](http://www.unvlt.com)
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
  - 6. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
  - 7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
- B. All Ballasts:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- C. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to one 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.

## **2.06 ACCESSORIES**

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

## **2.07 ACCESSORIES**

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- 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.
- F. Examine substrate and supporting grids for luminaires.
- G. Examine each fixture to determine suitability for lamps specified.

## **3.02 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

## **3.03 INSTALLATION**

- A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- F. Install wall mounted luminaires, emergency units and exit signs at height as indicated on Drawings and directed in the field by Architect. Obtain final approval from Architect prior to commencement of this portion of work.
- G. Install accessories furnished with each luminaire.

- H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- I. Suspended Ceiling Mounted Luminaires:
  - 1. Do not use ceiling tiles to bear weight of luminaires.
  - 2. Support luminaires larger than 2 foot by 4 foot size independent of ceiling framing.
  - 3. Secure pendant-mounted luminaires to building structure.
  - 4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  - 5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- J. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Install recessed luminaires to permit removal from below.
  - 3. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
  - 4. Install clips to secure recessed grid-supported luminaires in place.
- K. Suspended Luminaires:
  - 1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - 2. Unless otherwise indicated, support pendants from swivel hangers.
- L. Install accessories furnished with each luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. 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.
- O. 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.
- P. Install lamps in each luminaire.
- Q. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - 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/Engineer.
- F. Energy Code Commissioning: The electrical contractor shall program, test, calibrate and confirm the proper operation and placement of all lighting controls in accordance with the International Energy Code, 2012 Edition Paragraph C408.3 "Lighting system functional testing".

### **3.05 ADJUSTING**

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect/Engineer. 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/Engineer 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/Engineer or authority having jurisdiction.
- D. Relamp luminaires which have failed lamps at completion of work.

### **3.06 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.

### **3.07 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. Demonstration: Demonstrate proper operation of luminaires to Architect/Engineer, and correct deficiencies or make adjustments as directed.
- C. Just prior to Substantial Completion, replace all lamps that have failed.
- D. Project record documents: Accurately record location of each luminaire.

### **3.08 PROTECTION**

- A. Protect installed luminaires from subsequent construction operations.

**END OF SECTION**

**SECTION 27 10 00  
STRUCTURED CABLING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Project drawings, all divisions of the specification, general provisions of the Contract, including General Conditions apply to this specification section.
- B. Architectural drawings (includes interior architectural drawings).

**1.02 SUMMARY**

- A. Section and Scope of Work Includes
  - 1. Installation of all low voltage cable, connectors, faceplates, outlet housings, patch panels, cable support systems, cable ties..
  - 2. Verification testing and documentation of each installed cable and termination outlined below.
  - 3. Fire stopping all telecommunication penetrations through fire rated barriers created as a pathway for voice and data cabling and infrastructure with code, and AHJ compliant UL-rated assemblies.

**1.03 REFERENCES**

- A. Reference Data:
  - 1. To ensure conformance to the Work described in the Contract Documents, the Trade Contractor shall have access to, and adhere at all times to, the most recent version of any Codes, Publications and Industry Standards noted, below.
  - 2. If the year of the adoption or latest revision is omitted from any designation, it shall mean the specification, manual or test designation in effect the date the Notice to Proceed with the Work is given shall be utilized as the most accurate year and date of record.
  - 3. All work must conform to the most stringent of applicable codes. If during installation the Contractor identifies work that does not meet the most stringent code, the Contractor is to stop work immediately on that portion of the project and notify the Owner in writing. The Contractor must understand and have a working knowledge of all applicable codes.
  - 4. Contractor shall keep on site and available for review all standards, codes, and installation guidelines that govern the work specified in the Contract Documents. These shall include, but are not limited to: the current edition of the BICSI Telecommunications Distribution Methods Manual, TIA/EIA standards governing the telecommunications industry, and any installation guidelines specific to the selected manufacturer of system components.
  - 5. The reference material shall be on-site and readily available for review by field personnel, the Construction Manager, Designer and the Owner at any time throughout the Work.
- B. Codes (Note: Reference Division One for specific code versions governing the Work in addition to the information noted below.)
  - 1. FCC
    - a. Part 15 Unlicensed Radio Frequency Devices
    - b. Part 68 Terminal Equipment Certification Requirements
  - 2. National Electric Code, (NEC)
  - 3. National Electric Safety Code (NESC)

4. National Fire Protection Association (NFPA)
  5. State Electric Code
  6. State Building Code
  7. Local Municipal Codes
    - a. Electric Code
    - b. Building Code
- C. Industry Standard Requirements:
1. Underwriters Laboratories (UL)
  2. Telecommunications Industry Association/ Electronics Industries Alliance (TIA/EIA) publications and standards, including all related addenda and superseding documentation:
    - a. TIA/EIA 568-B.1: Commercial Building Telecommunications Wiring Standard Part-1: General Requirements and all related addenda.
    - b. TIA/EIA 568-B.2: Commercial Building Telecommunications Wiring Standard Part-2: Balanced twisted pair cabling standard and all related addenda.

#### **1.04 SUBMITTALS**

- A. Submit product data and test results.

### **PART 2 - PRODUCTS**

#### **2.01 SUMMARY**

- A. The Trade Contractor is required to furnish, install, label, certify, warrant, and guarantee the performance of a complete, functional, standards-based technology utility as described herein. This includes all materials, products, and skilled labor necessary to provide this complete utility whether specifically described in this section, the Contract Documents or, implied by the general intent provided by the description of the Voice Data Communication System within the Contract Documents.
- B. The Contract Documents define the minimum acceptable quality and performance of a component by describing attributes, performance, and other associated standards and by designating a manufacturer's trade or brand name or part number associated with the voice data communications system or components of the voice data communications system.
- C. All products selected by the Contractor based on the Contract Documents shall be reviewed and approved by the Designer and Owner even if products are noted within the minimum acceptable quality and performance descriptions noted below.
- D. For products described only by attributes, performance or standards, the Contractor shall select products that meet or exceed the specified attributes verified by two (2) independent sources within the past 6 months, treat them as substitute products or components, and submit a request for Designer and Owner approval of their use. This request shall include the two (2) independent sources, the original product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
- E. All products for which no substitute is allowed are so described as such by omitting the designation term "or equal" within the Contract Documents. See 2.02, Substitutions and Alternates, below.

- F. All Product shall be new, unused and in perfect condition upon arrival at the Project Site, prior to installation, and prior to acceptance by the Owner. It shall be the Trade Contractor's responsibility to verify the status of the products and report, in writing to the Designer and Owner, any products that do not conform to the requirements described within the Contract Documents prior to installation. Commencement of the Work described herein associated with each system component constitutes the Trade Contractor's acceptance of new and unused products as stated.

## **2.02 HORIZONTAL CATEGORY 6 U/UTP CABLING**

- A. All premium performance four (4) pair category-6 UTP cable shall consist of eight (8) twenty-four (24) gauge, or greater, thermoplastic insulated solid twisted conductors that utilize the industry standard color code designations.
- B. All individual copper conductor insulation material shall be 100% FEP on all conductors when a plenum cable is required by code.
- C. The performance criteria for Horizontal UTP cable shall be above and beyond the specific EIA/TIA 568B standards for the particular cable's rating and shall show stable performance out to 500 MHz. A category-6-rated cable must perform over and above each of the current specification parameters for the published TIA 568B for category-5e.
- D. Category 6 UTP cable shall be a fluted design with a pair isolator/separator that supports voice, analog baseband video/audio, fax, modem, switched-56, T-1, ISDN, RS-232, RS422, RS-485, 10BASE - T Ethernet, Token Ring, 100Mbps TP-PMD, 100BASE-T Ethernet, 155 Mbps ATM, AES/EBU digital audio, 270 Mbps digital video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications, including 1 Gbps Ethernet, as well as all 77 channels (550 Mhz) of analog broadband video.
- E. UTP cable shall be rated per the installation environment as required by the local Authority Having Jurisdiction and/or National Fire Codes. Select an appropriate cable construction, including external jacket properties, when installing cables in aerial, outdoor, underground and corrosive environments.
- F. Manufacturers - Category-6 UTP Cable
  1. Panduit - PUP6504WH-UY
  2. No substitutions.

## **2.03 UNIVERSAL UTP MODULAR OUTLET CONNECTORS**

- A. All Universal UTP Modular Outlet Connectors shall be rated to perform at or above current TIA/EIA performance parameters when terminating a copper cable within the voice/data communications system.
- B. All Universal UTP Modular Outlet Connectors shall have an eight (8) position, eight (8)-conductor module that accepts both RJ45 and RJ11 modular plugs. Performance of the outlet jack shall not be decreased with an RJ-11 modular plug at any time.
- C. When utilized as part of a channel or permanent link, all high performance modular outlet connectors shall not decrease the elevated category - 5e transmission requirements before and



after installation as specified in ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section in all noted performance parameters.

D. Manufacturers - Category-6 UTP Modular Outlet Connectors

1. Panduit - CFP\_IW

## 2.04 OUTLET HOUSING

- A. All outlet-housings at technology outlet locations shall provide the designated number modular insert ports as indicated on the Drawings. All flush-mounted faceplates shall be available in one (1), two (2), three (3), four (4), and six (6) port configurations of the same single gang style outlet and eight (8) port configurations of the same double gang style outlet.
- B. Color of all faceplates and outlet housing components shall be coordinated with the Owner before purchase and shall match electrical receptacle faceplates.
- C. Faceplates for flush floor mounted outlets shall be coordinated with the floor box that will be selected and installed by the Electrical Contractor.
- D. System furniture faceplates shall be capable of fitting in the furniture system selected by the Owner. Quantity of furniture faceplates shall satisfy outlet jack requirements. Furniture faceplate extenders shall be used if required to maintain proper bend radii within the furniture raceway/pathway. Colors shall be coordinated with the Owner before purchase.
- E. All outlet-housings shall provide a clear TIA/EIA 606-A labeling location for both the individual outlet port and the entire outlet housing location.
- F. Manufacturers - Outlet Housings
  1. Panduit - CFP\_IW
  2. No substitutions.

## 2.05 FIRE STOPPING

- A. All Fire Stopping material shall re-establish the integrity of fire-rated walls, floors, ceilings, etc. when these barriers are either partially or completely been penetrated by cables, conduit, slots and other penetration elements. In many cases, fire stop penetration seals may be required to perform other safety or security functions such as environmental protection seals.
- B. Provide fire-resistance protection using either a mechanical or non-mechanical fire stop system that consists of pre-manufactured elastomeric components shaped to fit around standard cables, tubes, and conduit.
- C. All Fire Stopping material associated with the telecommunications transport system shall comply with all applicable laws, regulations, standards, and codes and shall be re-enterable by design.
- D. If a non-mechanical fire stop system is to be used, the Contractor shall state what form will be used and state the properties of the material to be used in each specific situation, i.e., putty (with intumescent sheet materials, ceramic fiber or rock wool fill), caulk, silicone foam, pre-manufactured "pillows", or other materials of a cement-like nature.
- E. All Fire Stopping materials and methods shall be approved by the Owner for final approval by the Authority Having Jurisdiction (AHJ) prior to purchase and installation by the Contractor.

- F. Manufacturer - Firestop Systems
  - 1. Wiremold
  - 2. Nelson

## **2.06 LABELS**

- A. All Labels shall be machine-manufactured by a labeling machine. Handwritten labels will not be accepted for final labeling.
- B. The intention of the labeling scheme is to be TIA/EIA 606 compliant.
- C. It is the responsibility of the Contractor to acquire, understand, and utilize the Owner's labeling scheme for all component of the Voice Data Communications System including, but not limited to:
  - 1. Station cables (both ends)
  - 2. Workstation outlets Faceplates and Individual outlet connectors
  - 3. Termination panels, block, trays
  - 4. IT Room entry and exit pathways
  - 5. Telecommunication Conduit Pathways
- D. Manufacturer - Label Device
  - 1. Brady
  - 2. Or equal

## **2.07 CABLE TIES, VELCRO AND SPIRAL WRAP**

- A. Cable Ties shall be UL listed, rated, and approved for the installation environment they are utilized. All Cable Ties shall contain an internal, metal locking bard to provide consistent resistance and shall be provided where necessary in accordance with all EIA/TIA 568-B standards and BICSI guidelines.
- B. Hook and loop Velcro™ tie wraps shall be a one-piece wrap UL listed, rated, and approved for the installation environment they are utilized. Velcro™ tie wraps shall have hooks on one side and loops on the other side to allow attachment to itself. Velcro™ tie wrap length shall allow for a minimum of two inches (0'-2") overlap to achieve loop tensile rating.
- C. Heli-tube Spiral Wrap tubing shall be UL recognized, rated, and approved for the installation environment they are utilized. Spiral Wrap tubing shall wrap onto all exposed cable bundles like tape and be quickly and simply reusable allowing easy inline breakout of cables, if necessary.
- D. Manufacturer - Cable Ties, Velcro, and Spiral Wrap
  - 1. Thomas & Betts Cable Ties
  - 2. Panduit HLTP Velcro™ Wrap
  - 3. M.M. Newman HTxxxx Nylon Heli-Tube Spiral Cut Tubing
  - 4. Or equal

## **PART 3 - EXECUTION**

### **END OF SECTION**

## **SECTION 27 53 14 CLOCK SYSTEMS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Modification to remote station equipment and field wiring to accommodate remodeling project..

#### **1.02 REFERENCE STANDARDS**

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### **1.03 SYSTEM DESCRIPTION**

- A. Existing System: DuKane MC250/350. Clock and Program System: Synchronous wired, providing:
  1. Time standard signal for indicating clocks.
  2. Time period audible and visual signals.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate wiring diagrams and interconnection diagrams of new devices and existing system.
- C. Field Investigative Survey: Provide complete documentation of existing system condition prior to demolition.
- D. Product Data: Provide for each item of equipment; show specified ratings, colors, finishes, and physical dimensions.

#### **1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

#### **1.06 FIELD CONDITIONS**

- A. Existing Drawings: Existing Drawings are unavailable. Include necessary field survey work to document all system components and wiring arrangements prior to demolition.
- B. Maintain conditions to manufacturer's instructions during and after installation of clock system.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. DuKane (Existing).

## **2.02 COMPONENTS**

- A. Analog Indicating Clocks: Round analog indicating clock, synchronous motor type.
  - 1. Color: Black hands on white face.
  - 2. Housing: Stainless steel with gray color enamel finish, flush type.
  - 3. Provide double-face units where indicated.
  - 4. Voltage: 120 volts, 60 Hz.
  - 5. Size: 9 inch.
  - 6. Combination Housing: Provide cutouts to accommodate the following additional devices:
    - a. Volume control pad.
    - b. Intercom call switch.
  - 7. Backbox: Include integral receptacle.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install devices furnished under other sections into combination housings.

**END OF SECTION**

**SECTION 28 31 00  
FIRE DETECTION AND ALARM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Interface and reuse existing RF Transmitters for communication with supervising station.
- C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.
- D. Documentation of existing system components.
- E. Delegated Engineering Responsibility: Preparation of shop drawings and design of fire alarm system to the satisfaction of the local Authority Having Jurisdiction.

**1.02 REFERENCE STANDARDS**

- A. Provide all materials and labor in conformance with the following codes and standards:
  - 1. Village of Romeoville - Code of Ordinances.
  - 2. IBC International Building Code, 2009 Edition, with local amendments.
  - 3. IECC International Energy Conservation Code, 2015 Edition with local amendments.
  - 4. International Fire Code, First Edition, 2003, with local amendments.
  - 5. NFPA 72 - National Fire Alarm Code ; 2007 (Ref: Romeoville Code of Ordinances, Title IX, Paragraph 91.51)..
  - 6. Code for Safety to Life from Fire in Buildings and Structures (Life Safety Code, NFPA 101, 2003 edition).
  - 7. Automatic Fire Detectors, 2005 Edition (NFPA 72E).
  - 8. ADA-AG - American with Disabilities Act - Accessibility Guidelines.
  - 9. Illinois Accessibility Code, 1997 Edition (Illinois Administrative Code, Title 71, Chapter I, Subchapter b, Part 400).
  - 10. Underwriter's Laboratory.
  - 11. IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage Power Circuits; 1991 (R1995).

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Evidence of designer qualifications.
- C. Shop Drawings: 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:
- D. Existing System Verification: Owner drawings are not available. Perform on-site detailed Project Record Documents to detail all point-by point interconnection diagrams of entire system.
- E. Shop Drawings after existing system documentation and verification.
  - 1. Shop drawing submitted to Architect/Engineer shall be approved and signed by the authority having jurisdiction.

2. Submit point-to-point and single line wiring diagrams showing the point of connection and terminals used for all field connections.
  3. Submit diagrams showing all connections from field devices to control panel.
    - a. Include a detailed description of the control panel as it shall operate for this specific installation.
  4. Submit field wiring color-coding legend.
  5. Submit control panel interior wiring diagram.
  6. Indicate existing wiring arrangements and locations of devices and wiring routing.
  7. Copy (if any) of list of data required by authority having jurisdiction.
  8. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  9. 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.
  10. System zone boundaries and interfaces to fire safety systems.
  11. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  12. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
  13. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, circuit length limitations, dimensions, ratings, layouts and complete catalog numbers.
    - a. Submit UL listings with cross-listing substantiation for each system component clearly marked.
  14. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  15. 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.
  16. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
  17. Certification by Contractor that the system design complies with the contract documents.
  18. Do not show existing components to be removed.
- F. Evidence of installer qualifications.
- G. Evidence of instructor qualifications; training lesson plan outline.
- H. Evidence of maintenance contractor qualifications, if different from installer.
- I. 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.
- J. Project Record Documents: See Section 01 78 00 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 his 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. Final shop drawings approved and signed by the local authority having jurisdiction.
4. Submit record of affected circuit acceptance test.
5. Submit written statement by installing contractor that the system has been installed and tested in accordance with approved plans, specifications and NFPA requirements.
6. Include actual field conditions including location of end-of-line resistors, cable outing, color coding, terminations, devices and equipment.
7. Include written sequence of operation.

#### 1.04 QUALITY ASSURANCE

- A. Designer: Qualified employee of fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
1. Delegated Engineering Responsibility: Provide design services necessary to modify initiating device circuits, notification circuits and affected control panels and power supplies. Provide all necessary drawings and specification to local authority having jurisdiction for approval to modify this existing system as intended.
- B. Manufacturer: Qualified company specializing in smoke detection and fire alarm systems with five years documented experience.
- C. Installer: Qualified firm with minimum 5 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
  2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
  3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
- D. Maintenance Contractor: 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. Qualified personnel includes those persons that are:
1. Factory trained and certified; OR
  2. NICET Level III or IV (3 or 4) Fire Alarm certified; OR
  3. International Municipal Signal Association Fire Alarm certified; OR
  4. Certified by state (Illinois Department of Professional Regulation); OR

5. Trained, qualified, and employed by an organization listed by a national testing laboratory.

## **1.05 EXISTING CONDITIONS**

- A. The existing fire alarm system control panel is an interconnected control unit. System is currently under construction.
  1. The existing initiating device circuits and notification appliance circuits will be modified to relocate devices to accommodate this interior remodeling project.
  2. Available Drawings: Shop Drawings for system expansion requirements.
    - a. Existing Control Panels:
      - 1) Edwards EST3 (Under construction)
        - a) Central Processor Unit: 3-CPU1
        - b) Primary Power Supervision Model: 3-PPS/M
        - c) Data Controller: 3-SDDC
        - d) Off Premises Signal Module: 3-OPS
        - e) Network Interface: Multimode Fiber
        - f) Power Supply: 24 VDC, 45 AH.
      - 2) Simplex Devices(labeled Model 4020)
        - a) Simplex 8 point I/O Assembly Module 0565-211
        - b) Power Supply: 24 VDC.
        - c) Additional Components Remote
      - 3) City Tie (Remote Station)
        - a) Keltron Model RF774F Wireless Transceiver
    3. Provide new equipment compatible with existing devices and system at site.

## **PART 2 PRODUCTS**

### **2.01 FIRE ALARM SYSTEM**

- A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:
  1. Provide all components necessary, regardless of whether shown in the contract documents or not.
  2. Protected Premises: Areas denoted on the drawings.
  3. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
  4. Zoning: Existing.
  5. Existing Control Panel: Make modifications to the existing panel:
    - a. Additional Power Supplies: Adequate to serve control panel modules, remote detectors, keypads, door holders, relays and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 60 hours followed by alarm mode for 5 minutes.
- B. Supervising Stations and Fire Department Connections:
  1. Existing connections to remain.
- C. Circuits:
  1. Initiating Device Circuits (IDC): Class B, Style A.
  2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
  3. Notification Appliance Circuits (NAC): Class B, Style W.



4. All cabling shall be plenum rated.

D. Power Sources:

1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified..

## 2.02 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.

## 2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Alarm (Existing): Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.
2. Trouble(New): Duct smoke detectors.

B. HVAC (New):

1. Duct Smoke Detectors: Shut down all air handlers (furnaces).

## 2.04 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Power Supplies, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Initiating Devices:

1. Duct Mounted Smoke Detector: Compatible with existing module. Photoelectric type, duct sampling tubes extending width of duct, in duct-mounted housing compatible with control panel and air stream velocities. Fan control shall not be hard wired through duct detector. Fan shutdown shall be completed by fan shutdown relay.
- 2.

D. Notification Appliances:

1. Horn/Strobes: NFPA 72 and UL 1971; electronic horn rated 90 dBA average at 10 feet. Provide integral 110 candela strobe lamp and flasher. Provide red trim ring for semi-flush mounting. Synchronize strobes within site of each other. Compatible with control panel.
2. Strobes: NFPA 72 and UL 1971; Provide integral 110 candela strobe lamp and flasher. Provide red trim ring for semi-flush mounting. Synchronize strobes within site of each other. Compatible with control panel.

E. Circuit Conductors: Copper; provide 20 feet extra; color code and label.

## 2.05 SYSTEM DESIGN

- A. Operation (Existing): System shall be complete supervised for fire alarm circuits, general evacuation, zoned fire alarm systems. System shall be activated into the fire alarm mode by actuation of any verified fire alarm initiating device. System shall remain in the alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. Upon system reset.
- B. Operational Features (Existing): The system shall have the following:
1. Class B supervision of fire alarm initiating circuits and alarm indicating circuits.
  2. Electrical supervision of the primary power (AC) supply, presence of the battery voltage, within the control panel.
  3. Trouble buzzer and trouble light to activate upon a single-break or open condition, or ground fault on a fire alarm initiating circuit which prevents the required operation of the system. The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, removal of alarm zone modules. Provide a trouble alarm silence switch which will silence the trouble buzzer but will not extinguish the trouble indicator light. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.
  4. Any FACP trouble and supervisory condition shall signal a trouble or supervisory condition to supervising station.
  5. Final sequence of events shall satisfy the AHJ.
- C. Alarm Functions: An alarm condition from manual pull station, verified smoke or automatic detector, fire suppression initiating device shall automatically initiate the following functions:
1. Visual indication of the zone operated on the fire remote annunciator panel and control panel.
  2. Continuous sounding alarm indicating horn/strobe devices.
  3. Shut down building heating/ventilating system fans.
  4. Transmit alarm to supervisory station via fire alarm control panel transmitter.
- D. Supervisory Alarm (If Available): A supervisory alarm shall automatically initiate the following functions:
1. Visual and audible indication of the device operated at the fire alarm panel annunciator for associated zone.
  2. Transmit supervisory alarm to supervisory station via fire alarm control panel transmitter.
  3. Audible indication of device throughout protected premises with distinctly different tone from alarm.
- E. Primary Power: Power shall be 120 volts from a dedicated AC service circuit. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm.
- F. Emergency Power: Provide lead calcium, rechargeable, sealed type storage battery. The emergency power shall operate in the event of the loss of primary power.

- G. Wiring: Wiring shall be solid copper and installed in electrical metallic tubing conduit throughout all exposed areas. Flexible metallic conduit may be used for the drops to devices from accessible junction boxes where it must be "fished" inside wall.
1. Conductors for low voltage DC initiating circuits shall be solid No. 18 AWG minimum.  
Conductors for alarm indicating horn/strobe circuits shall be No. 14 AWG minimum.  
Conductors for 120 V circuit shall be No. 12 AWG minimum, 600 VAC rated.
  2. Wire for 120V circuits shall not be in the same conduit as low voltage DC circuits. Identify circuit conductors within each enclosure where a tap, splice or termination is made.
  3. Conductor identification shall be by plastic coated self-sticking printed markers or by heat-shrink type sleeves. Attach markers in a manner that will not permit accidental detachment. Identify, control circuit terminations.
    - a. All conductors shall be color coded and 300 volt rated (minimum).
    - b. Conductors used for the same functions shall be distinctively color coded.
    - c. Use two different color codes for each alarm circuit; one for each loop.
  4. Interconnect batteries, fire alarm control panel and battery charger by not greater than 10 foot of No. 12 AWG conductor.
  5. Pigtail or T-tap connections to alarm initiating and alarm indicating circuits are unacceptable.
  6. Conductors shall be plenum rated.
- H. Splicing for any fire alarm circuits is prohibited except by means of terminal strips or blocks, utilizing screw type terminals located in properly sized junction, pull boxes or within the fire alarm control panel.
- I. Circuit Connections: Connect all circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate end-of-line resistors, diodes and relays, if any, in the fire alarm control panel.
- J. Storage Batteries: Provide batteries with proper ampere-hour rating to operate the system including space capacity under supervisory conditions for 60 hours and following this period of operation capable of operating all alarm indicating devices under alarm conditions for 5 minutes. Batteries shall have lead bolt-on or wing-nut type terminals.
1. Batteries with fast-tab terminals are unacceptable. Provide reliable separation between cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts.
  2. Locate each set of system batteries in a steel cabinet with non-corrosive base, and cylinder lock and key feature, finished on the inside with corrosion resistant paint and outside with enamel.
  3. Locate cabinets to allow convenient viewing and servicing of the batteries. Each cabinet shall have twice the volume of the batteries it will contain.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION AND PREPARATION**

- A. Field inspect existing fire alarm system installation to determine all required interface components necessary for fire alarm system replacement and relocation.
- B. Perform repair work on existing system to eliminate trouble conditions.

### **3.02 INSTALLATION**

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.
- B. Install fire alarm system in accordance with manufacturer's instructions.
  - 1. Mount end-of-line device in separate box adjacent to sprinkler flow switch.
  - 2. Make conduit and wiring connections to fire suppression system at fire sprinkler riser and elevator tamper switches and duct smoke detectors.
  - 3. Install manual station with operating handle 4 feet above floor. Install horn strobe units 7.5 feet above floor.
- 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.

### **3.03 INSPECTION AND TESTING FOR COMPLETION**

- A. Perform field inspection and testing of fire alarm system in accordance with Section 01 78 00.
- B. Notify Owner 7 days prior to beginning completion inspections and tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- F. Provide all tools, software, and supplies required to accomplish inspection and testing.
- G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
  - 1. Include description of testing and results in test report.
  - 2. Perform 100 percent acceptance test to NFPA 72 standards on system.
- H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

### **3.04 CLOSEOUT**

- A. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
  - 1. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.

**END OF SECTION**

**SECTION 31 23 16  
EXCAVATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Excavating for footings, slabs-on-grade, and utilities within the building.

**1.02 RELATED REQUIREMENTS**

- A. Civil Engineering Drawings: Site clearing, topsoil stripping, stockpiling and respreading; grading requirements; trenching requirements for utilities outside the building envelope; fill requirements for areas outside the building foundation backfill area.
- B. Section 31 23 23 - Fill: Fill materials, filling, and compacting.

**1.03 PROJECT CONDITIONS**

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.

**1.04 SEQUENCING AND SCHEDULING**

- A. Schedule, sequence and coordinate the work of this section, and prior and subsequent portions of the work, in accordance with the requirements of Section 01 40 00 - Quality Requirements.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

**3.02 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities.

**3.03 EXCAVATING**

- A. Underpin adjacent structures that could be damaged by excavating work.
- B. Excavate to accommodate new structures and construction operations.
- C. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- D. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Cut utility trenches wide enough to allow inspection of installed utilities.
- G. Hand trim excavations. Remove loose matter.

- H. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
- I. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23.
- J. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- K. Remove excavated material that is unsuitable for re-use from site.
- L. Stockpile excavated material to be re-used in area designated on site .
- M. Remove excess excavated material from site. Haul and dump at landfill accepting waste of type generated by excavation operations.

#### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

#### **3.05 PROTECTION**

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

**END OF SECTION**

**SECTION 31 23 23**  
**FILL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, and utilities within the building.
- B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

**1.02 RELATED REQUIREMENTS**

- A. Civil Engineering Drawings: Backfilling and compacting for utilities and other areas outside the building envelope, additional requirements for removal and handling of soil to be re-used, site grading,
- B. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

**1.03 DEFINITIONS**

- A. Finish Grade Elevations: Indicated on Civil Engineering Drawings.

**1.04 REFERENCE STANDARDS**

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 2012.
- C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN m/m<sup>3</sup>)); 2012.
- D. SSRBC - Standard Specifications for Road and Bridge Construction, adopted by the Illinois Department of Transportation on January 1, 2002, including applicable current Supplemental Specifications and Special Provisions.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Compaction Density Test Reports.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.

## **1.07 SEQUENCING AND SCHEDULING**

- A. Schedule, sequence and coordinate the work of this section, and prior and subsequent portions of the work, in accordance with the requirements of Section 01 40 00 - Quality Requirements.

## **PART 2 PRODUCTS**

### **2.01 FILL MATERIALS**

- A. General Fill: Subsoil excavated on-site.
  - 1. Graded.
  - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris, waste, frozen materials, vegetable and other deleterious matter.
- B. Structural Fill: Subsoil excavated on-site.
  - 1. Graded.
  - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris, waste frozen materials, vegetable and other deleterious matter.
- C. Granular Fill: Crushed stone conforming to SSRBC; CA-6.
- D. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
- E. Topsoil: Topsoil excavated on-site.
  - 1. Graded.
  - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
  - 3. Acidity range (pH) of 5.5 to 7.5.
  - 4. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.

### **2.02 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. If tests indicate materials do not meet specified requirements, change material and retest.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that survey bench marks and intended elevations for the Work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. See Section 31 22 00 for additional requirements.
- D. Verify structural ability of unsupported walls to support imposed loads by the fill.

### **3.02 PREPARATION**

- A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.



- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

### **3.03 FILLING**

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
  - 1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 98 percent of maximum dry density.
  - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated:
  - 1. Under slabs-on-grade: 95 percent of maximum dry density.
  - 2. At areas under building foundations: 98 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.

### **3.04 FILL AT SPECIFIC LOCATIONS**

- A. Under Interior Slabs-On-Grade:
  - 1. Use granular fill.
  - 2. Depth: 4 inches deep unless indicated otherwise on the Drawings.
  - 3. Compact to 95 percent of maximum dry density.
- B. At Foundation Walls and Footings:
  - 1. Use general fill.
  - 2. Fill up to subgrade elevation.
  - 3. Compact each lift to 90 percent of maximum dry density.
  - 4. Do not backfill against unsupported foundation walls.

### **3.05 TOLERANCES**

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

### **3.06 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
- C. If tests indicate work does not meet specified requirements, See Section 01 40 00 for procedures.
- D. Frequency of Tests: Test compaction of existing, graded and placed materials no more than seven (7) days prior to placement of the next portion of the Work, and only when no rain is expected between the time of the test and the placement of the next portion of the Work. Proceed with the subsequent portions of the Work only after satisfactory results have been verified in writing.

### **3.07 CLEANING**

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

**END OF SECTION**